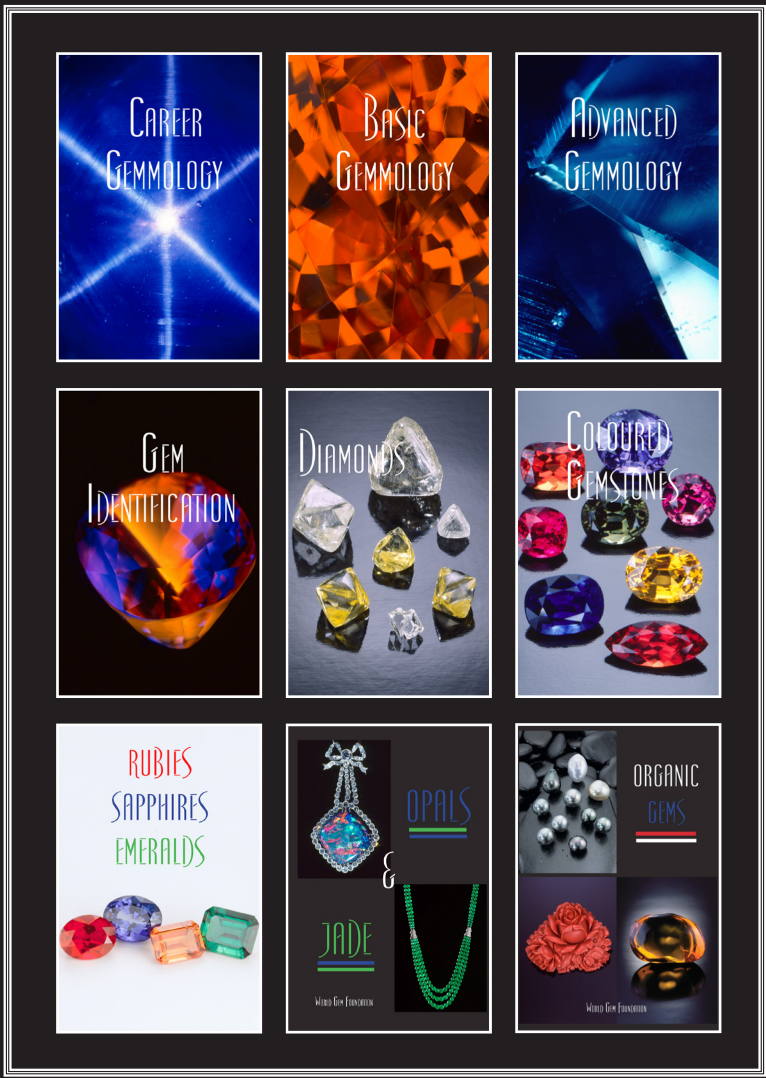
WORLD GEM FOUNDATION

Gemmology Today



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WORLD GEM FOUNDATION

In this issue

Cover Photograph by Anthony de Goutiere

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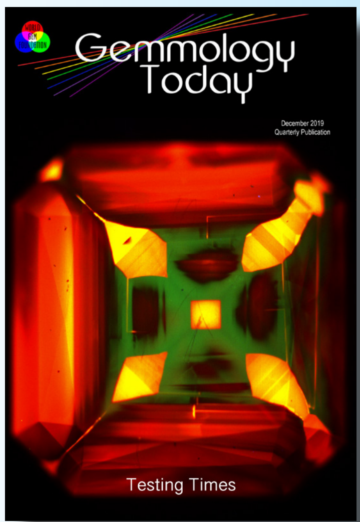
Editor Geoffrey M. Dominy



December 2019 Issue

Editor at Work

Geoffrey M. Dominy is the author and creator of the 'The Handbook of Gemmology' and 'Gemología Para Todos', founder of the World Gem Foundation and editor of Gemmology Today.

Anthony De Goutiere started out his life in Mallorca, Spain and eventually made his way to Victoria, Canada.

I started out my life in England, moved to Calgary, Canada in 1972 and then to Victoria in 1979. During the four years I lived there, our paths crossed. I subsequently moved on to Edmonton, Winnipeg, Vancouver, Peru and I now live in Palma, Mallorca, a twenty minute bus ride from the town of Sóller where Tony was born.

When I heard that Tony had passed away, I contacted his family. I was not aware at that time that Tony was born in Mallorca. I admired his work and wanted to pay tribute to him by featuring his inclusion photography in this issue. It was during the correspondence I had with Penny and his son Paul that I realised the Mallorcan connection.

I think it is appropriate that a magazine, born and bred in Mallorca should pay tribute to a 'Mallorcan Son', who has made a significant contribution to the world of gemmology. I hope through the publication of his work, we can keep his images in the public domain. I also think he would be pleased that at least gemmologically, his life has gone full circle.

On another sad note, now that the British public have given a strong mandate to Boris Johnson, Brexit will become a reality. I am strongly against Britain leaving Europe and thought the voters would feel the same way when it came time to elect a new government. I was wrong. I cannot describe how sad and angry it makes me feel but I am one of the lucky ones courtesy of a British passport and a Spanish residency card. I really feel for my friends in the UK who wanted to stay. I cannot think of a political decision that has been made in my lifetime that has had such a profound affect on not just a small group of people but an entire population (both inside and outside the UK). A decision that will affect generations to come. Yes, I do understand why so many people were upset with the EU but opting for isolation and a dependency on the U.S and China for future trade. Is that a good idea? I know, I can hear readers saying that Gemmology Today is not a political publication and they are right but we all work in an international industry that is made infinitely easier when there are no barriers affecting the flow of merchandise.

As part of the new World Gem Foundation diamond study collection, we have added a number of CVD and HPHT diamonds from Chatham in the U.S. As I write this column, they are caught up in customs in Barcelona. This is what UK and EU buyers can expect when Brexit becomes reality. Not only the inconvenience of having to deal with customs and all the bureaucratic red tape that it entails but the added costs. This certainly will 'play on the minds' of buyers in the future. Our natural diamonds all came from our friends at IDEX in Antwerp. No fuss, no bother, just a simple insured shipment that was able to cross several borders without any need for the end user to pay any duties.

Let's hope I am wrong but building walls and creating obstacles to the free movement of products is the last thing anyone wants and I am certain it will impact on the many British businesses that rely on the importation and exportation of goods to and from the EU.

Finally, I am so grateful to all our contributors and to everybody who has shared our publication on social media. This is our fourteenth issue of Gemmology Today. It truly has become an international publication that knows no boundaries.......

Combining his love of photography with gemmology, he began a journey that would consume countless hours and produce a lasting legacy of his work. In 'Mallorcan Son', we pay tribute to Anthony de Goutiere, the man, his passion and his work.

Mallorcan Son

Anthony de Goutiere (1927 - 2019)

On December 25th, 2019 my father Anthony (Tony) de Goutiere passed away at 92 years old after a two year struggle with cancer.

He was born in Sóller, Mallorca, Spain in 1927 and grew up on the west coast of Canada eventually settling in Victoria.

From an early age he was fascinated by micro-engineering and cameras which would lead to an apprenticeship as a watchmaker in Toronto. He worked for Henry Birks & Sons, then Eaton's and finally opened his own store in May of 1960.

He quickly established himself as one of the top watch and clock makers on the coast and as business grew he began to add jewellery, discovering his next great love, gemstones.

Recognizing the need to understand what he was seeing and selling he completed the Gemological Institute of America's (G.I.A) gemmology program and was soon after accepted into the A.G.S. program leading him to being one of the first fully qualified gemmologists in Canada.

Combining his love of photography with gemmology, he began a journey that would consume countless hours all the way till shortly before he passed.

He became friends with John Koivula at the G.I.A. and was often sent what I would refer to as care packages, boxes of material that John had scoured and sent on to Dad for fresh eyes.

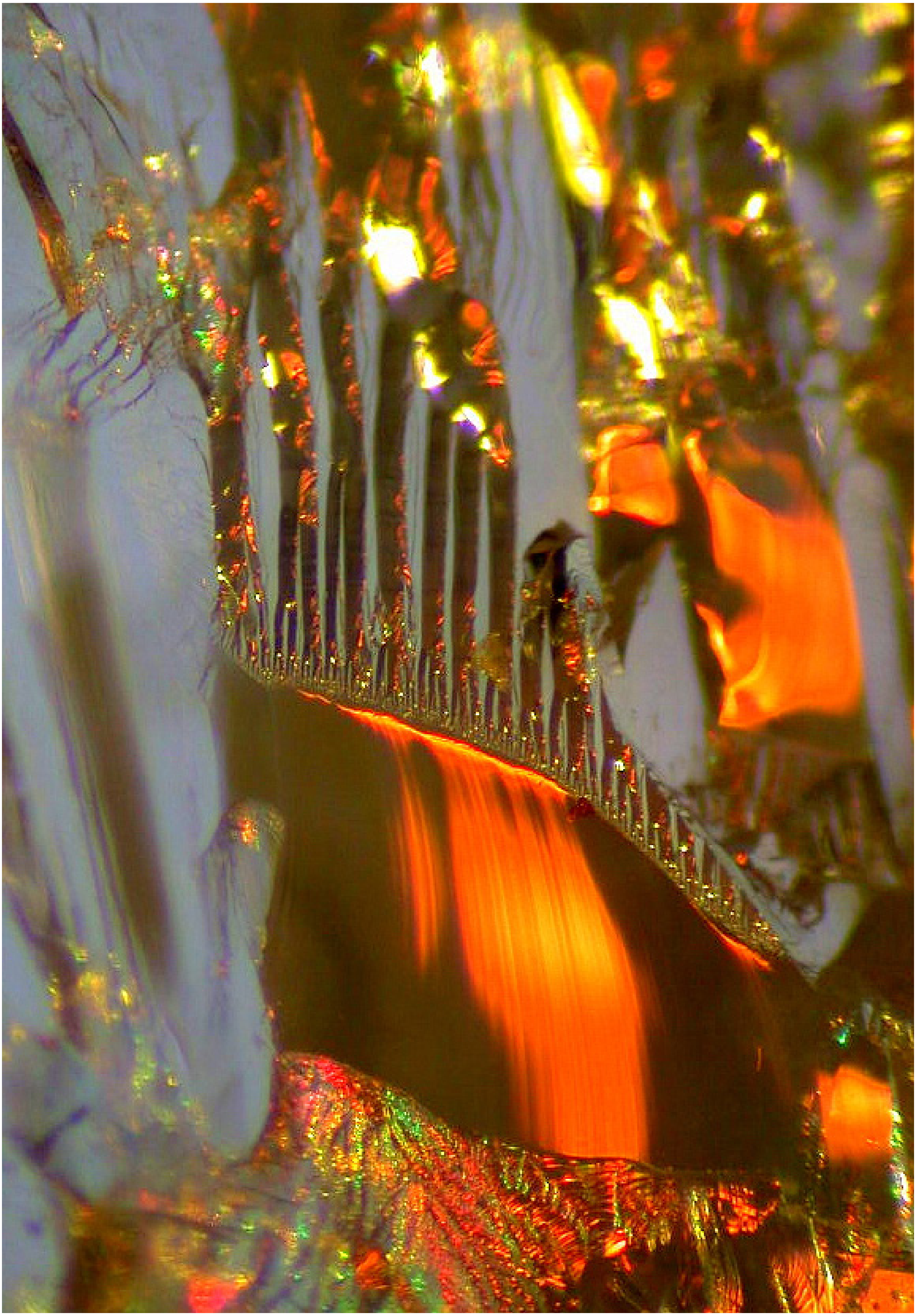
Dad retired in 1994 but not from photomicrography, he would go on to produce articles, two books (Wonders within Gemstones) and win numerous awards for his work culminating with a lifetime achievement award from the Canadian Gemmological Association in 2019.

When not behind a microscope, Dad loved sailing, playing classical guitar, travel and of course, photography. He was predeceased by his wife Jean (1997) and leaves behind partner Penny Joppe, daughter Julie, son Paul, four grandchildren, five great-grandchildren and many nieces and nephews.

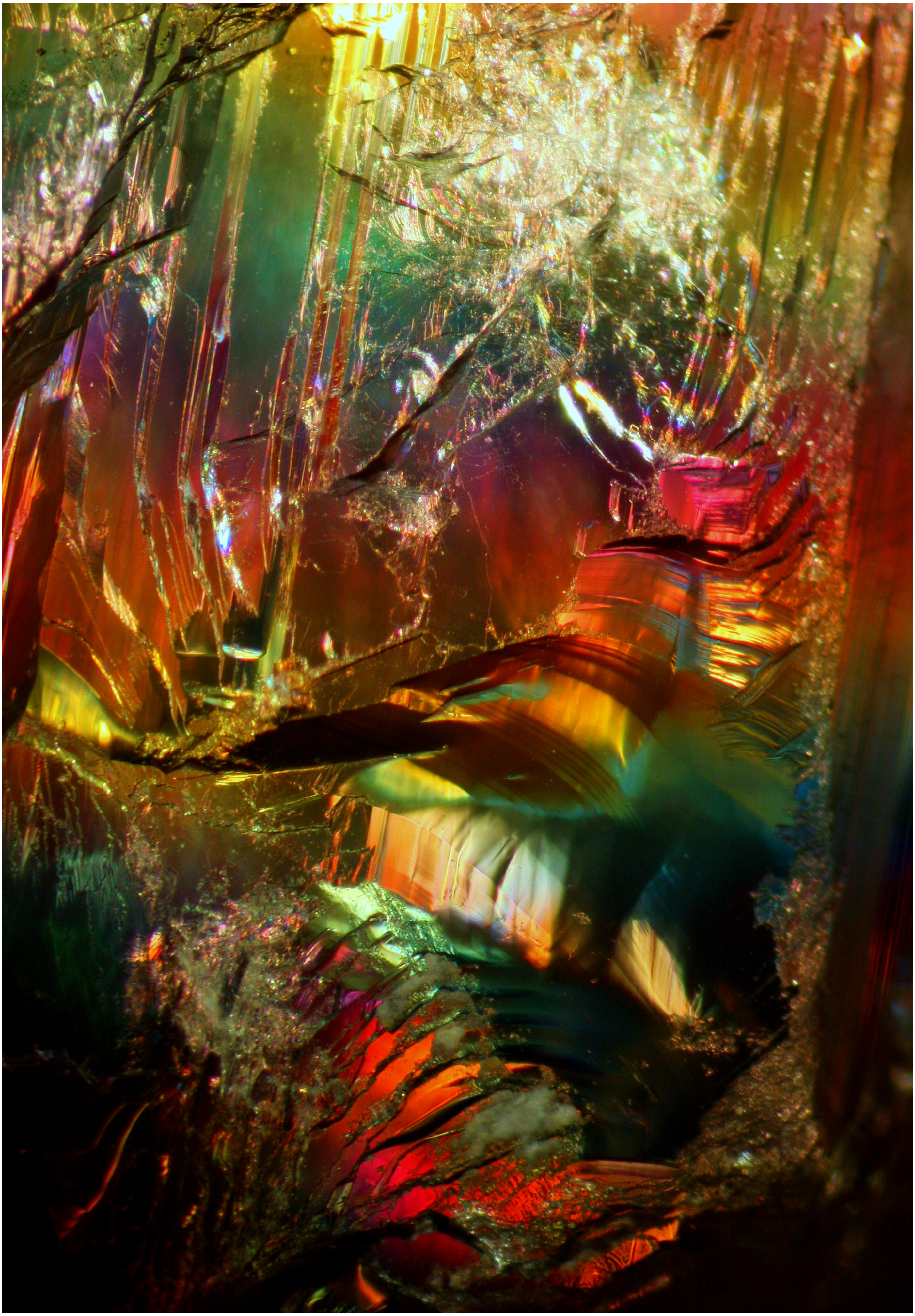
It's our hope that the following photographs will help to inspire others to pursue this amazing micro-world and we would also like to thank Gemmology Today and Geoff Dominy for generously allowing us to share these wonders within gemstones with their readers.

Paul de Goutiere - February 2020

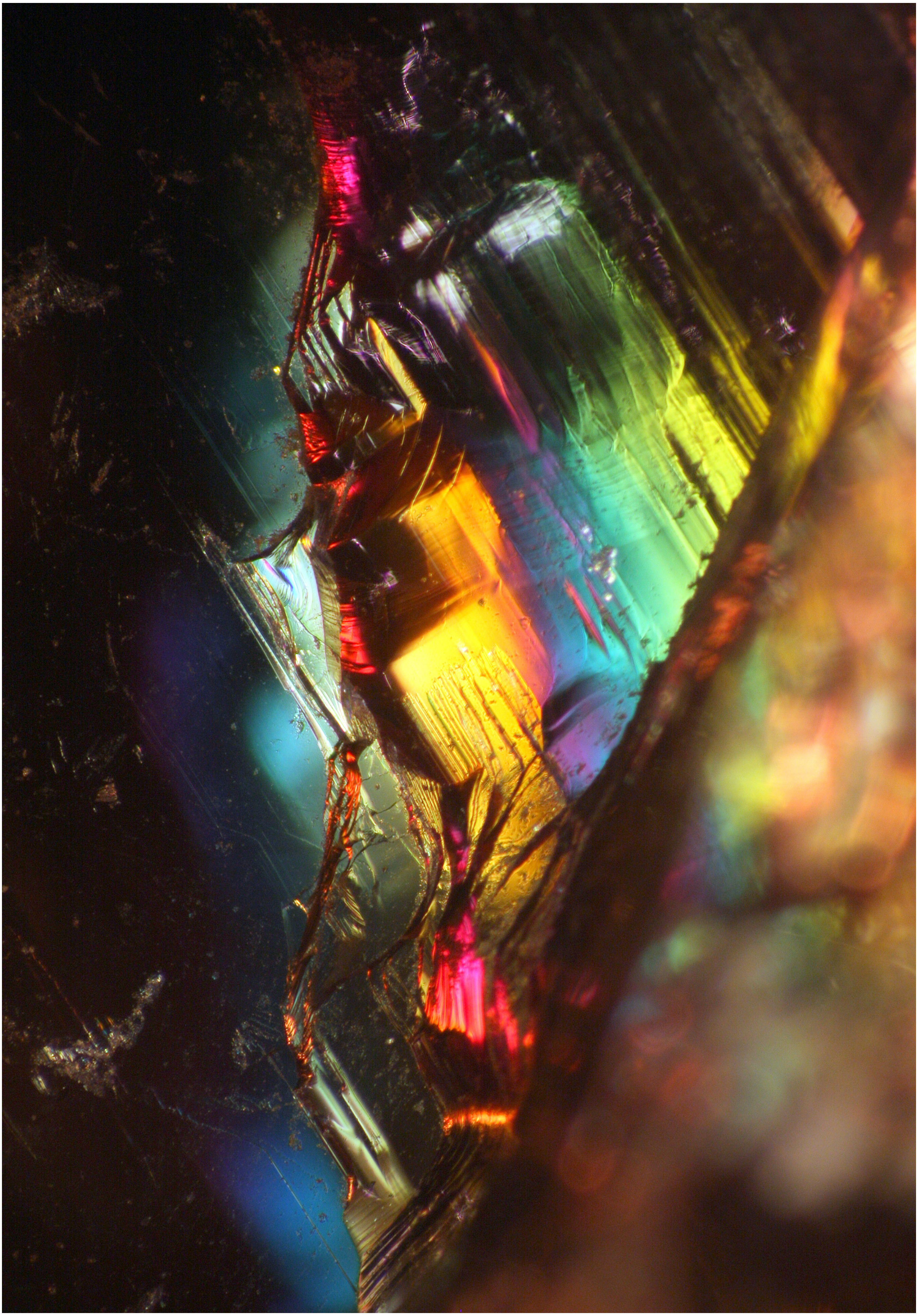
Editors Note: As a Mallorcan based publication, it seems very appropriate that we should pay tribute to Anthony and his work. We would also like to thank Penny and Paul for helping us to put this tribute together and John Koivula for the captioning of the images.

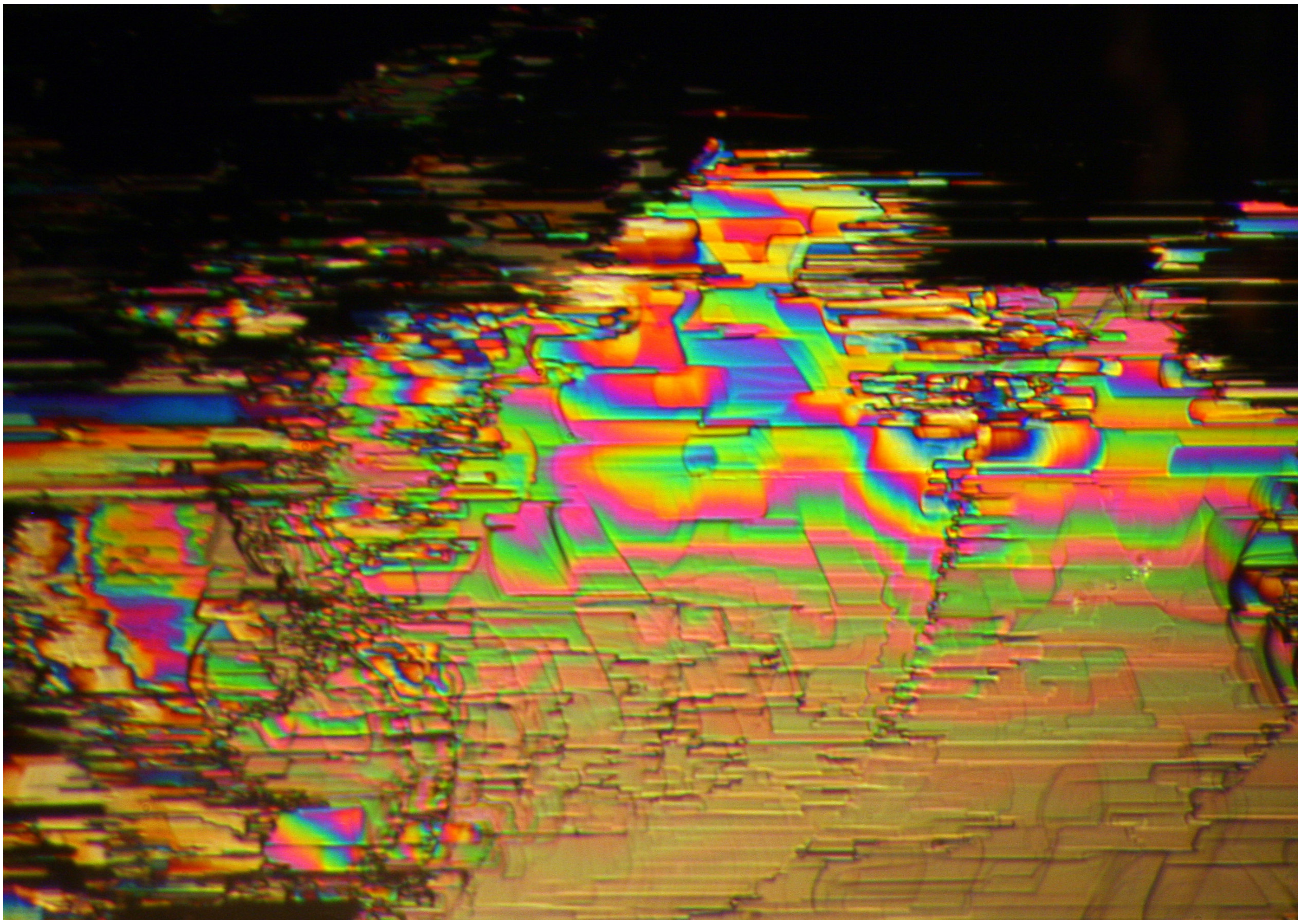


Cleavage and fracture pattern in a Topaz (Photo by Anthony de Goutiere)

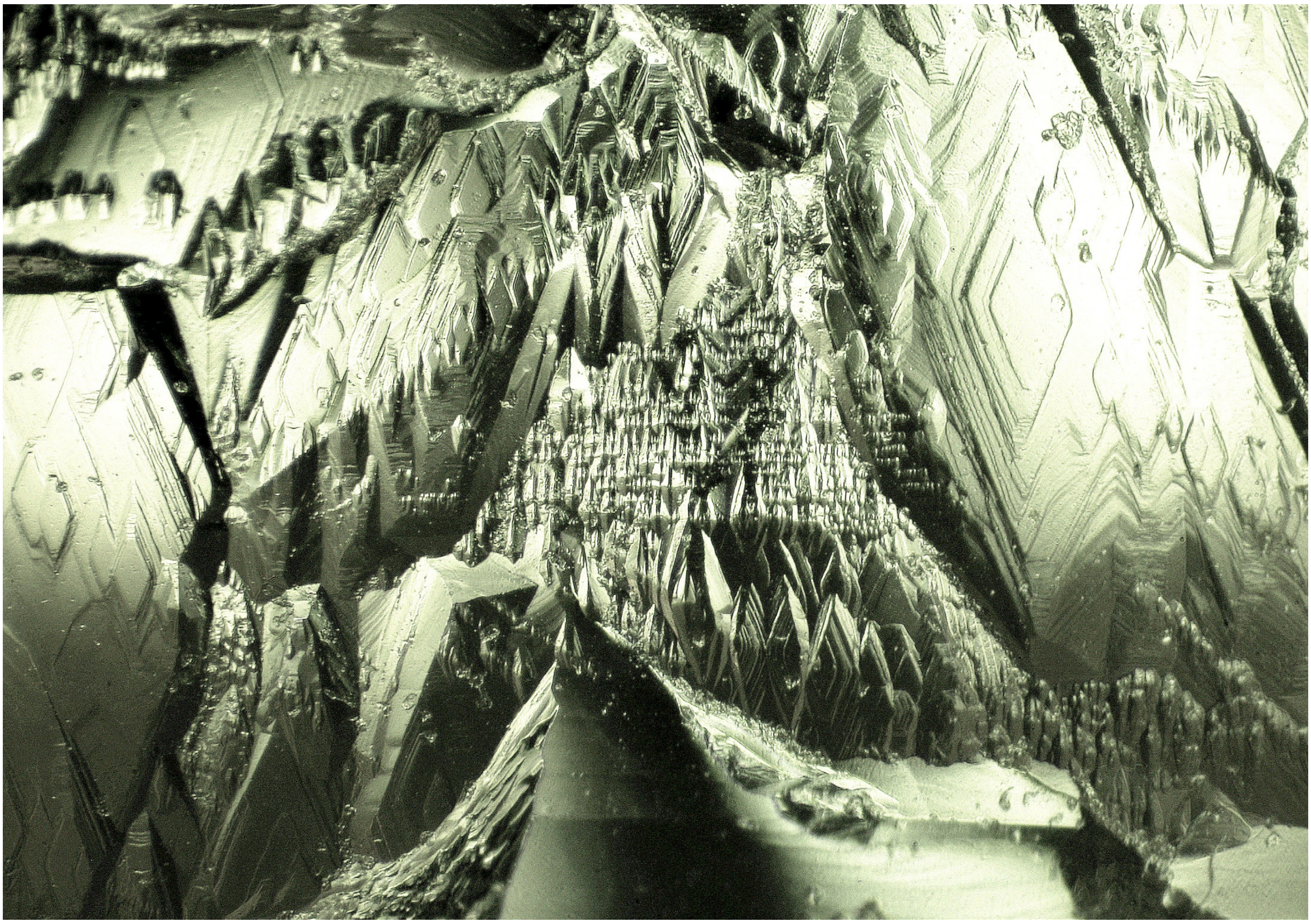


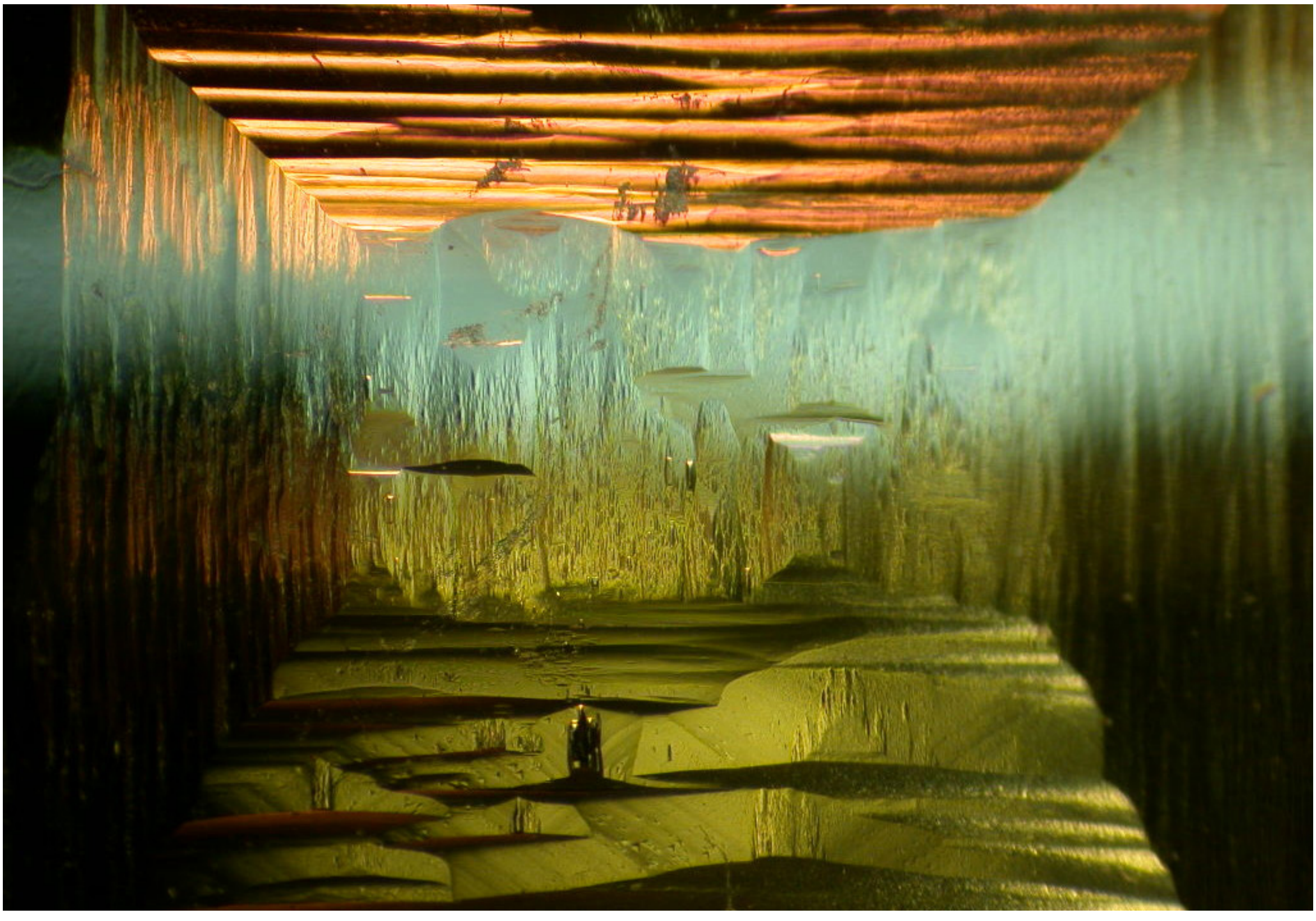
Fracture surface on a Diaspore (Photo by Anthony de Goutiere)

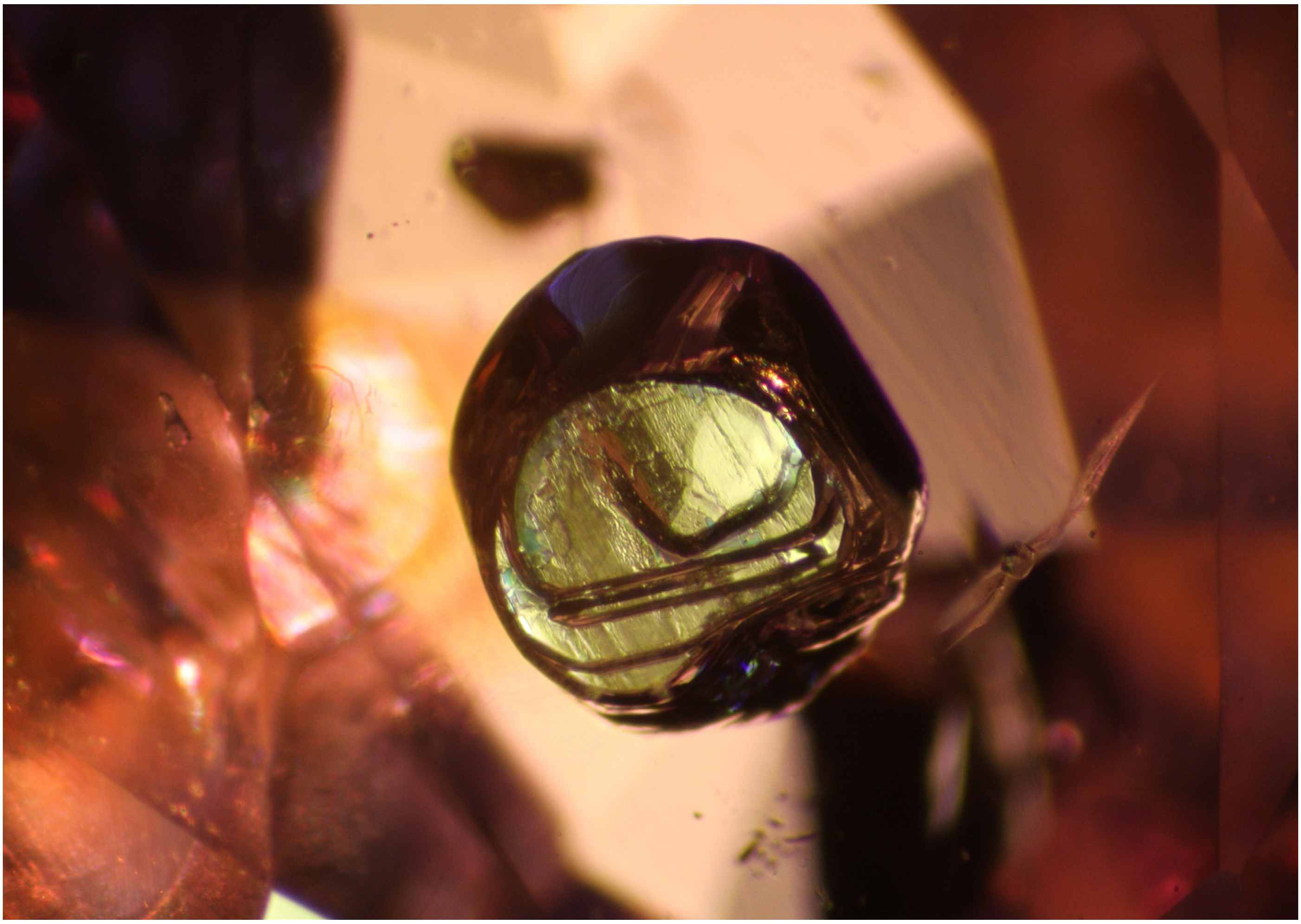

Inclusion pattern in a Diaspore (Photo by Anthony de Goutiere)

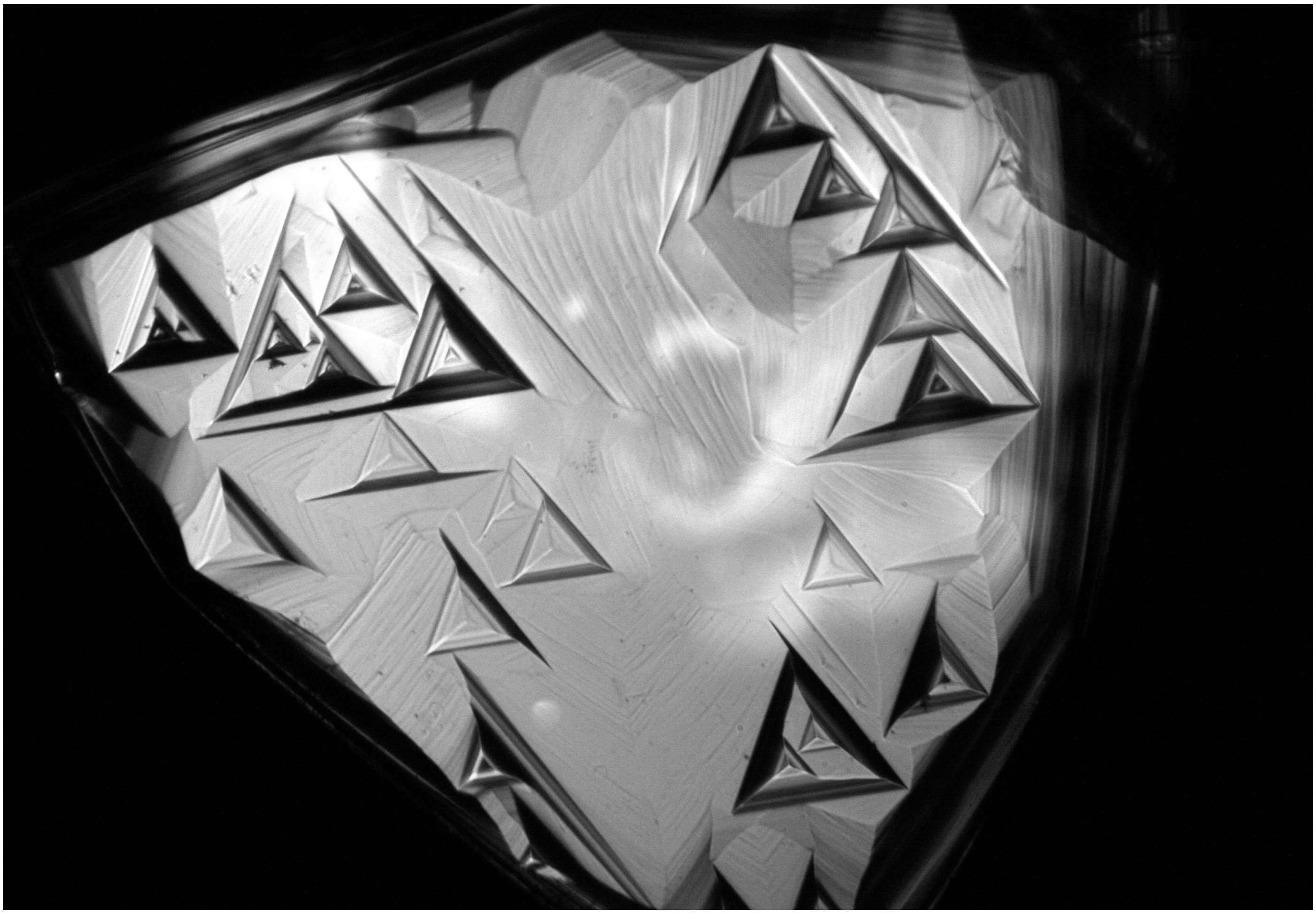

Inclusions in Diaspore showing iridescence (Photo by Anthony de Goutiere)

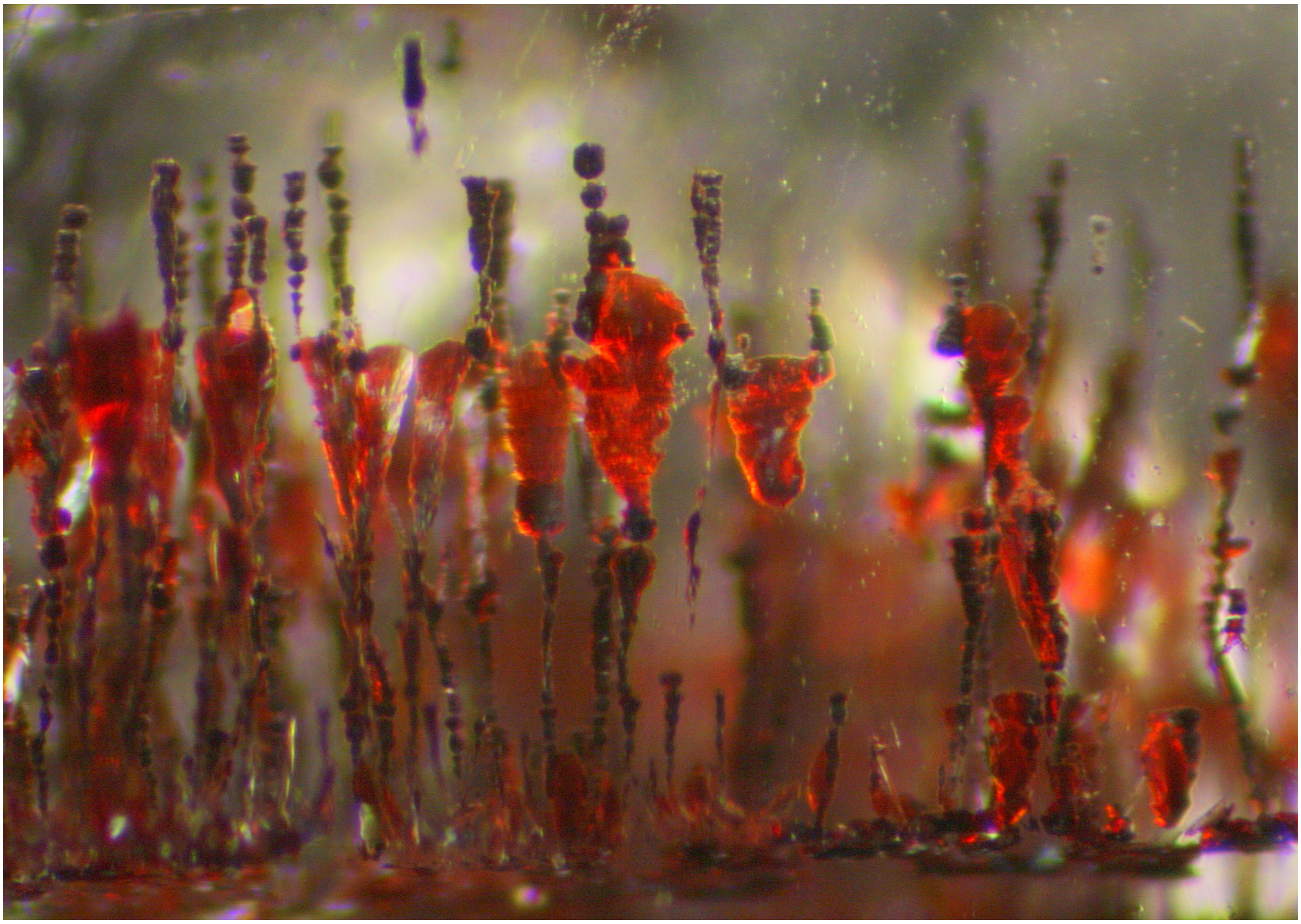

Fracture pattern on the surface of a Topaz (Photo by Anthony de Goutiere)


Surface etching on Beryl (Photo by Anthony de Goutiere)

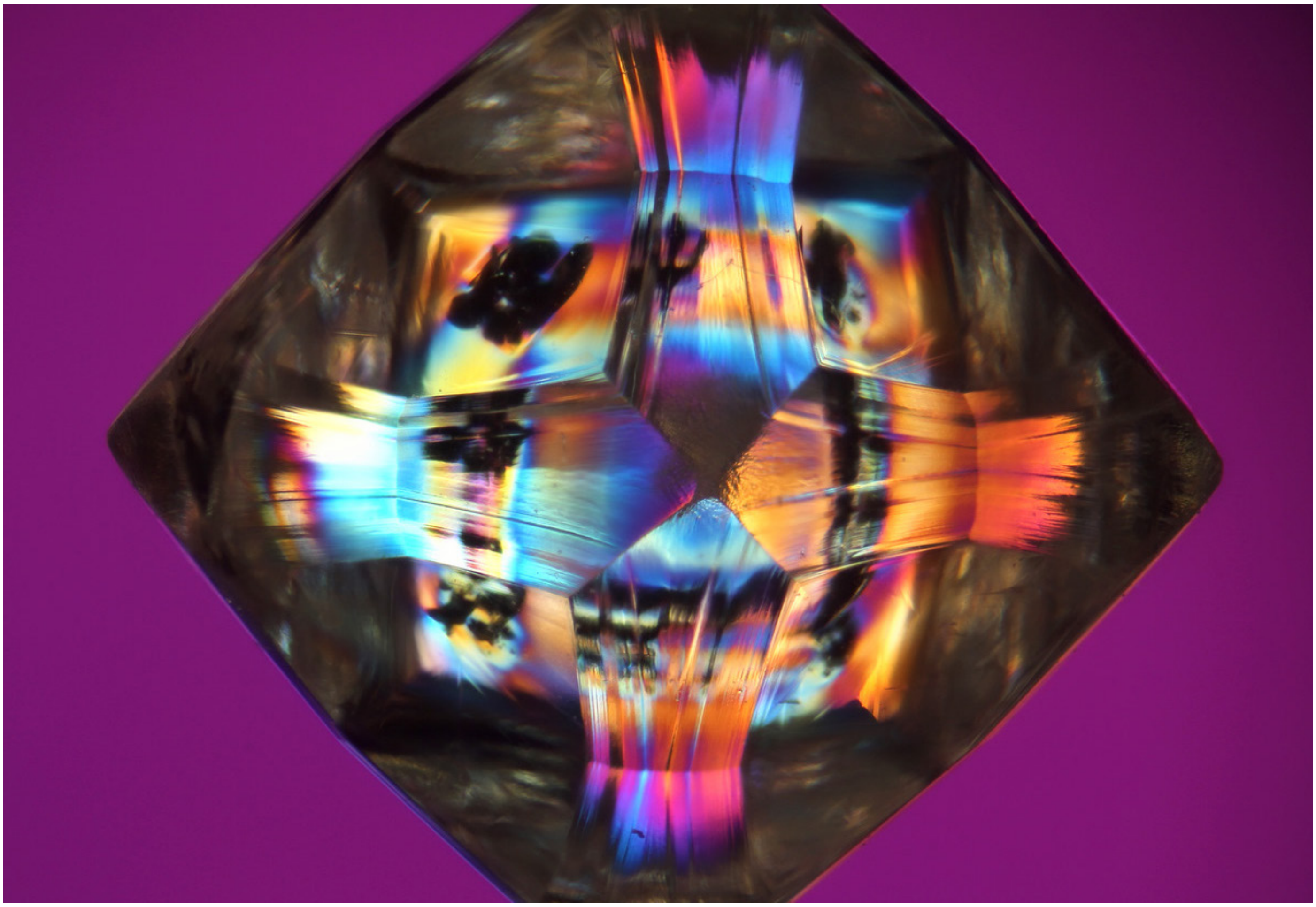

Inclusions observed in a Beryl crystal (Photo by Anthony de Goutiere)


Muscovite in Pink Sapphire (Photo by Anthony de Goutiere)

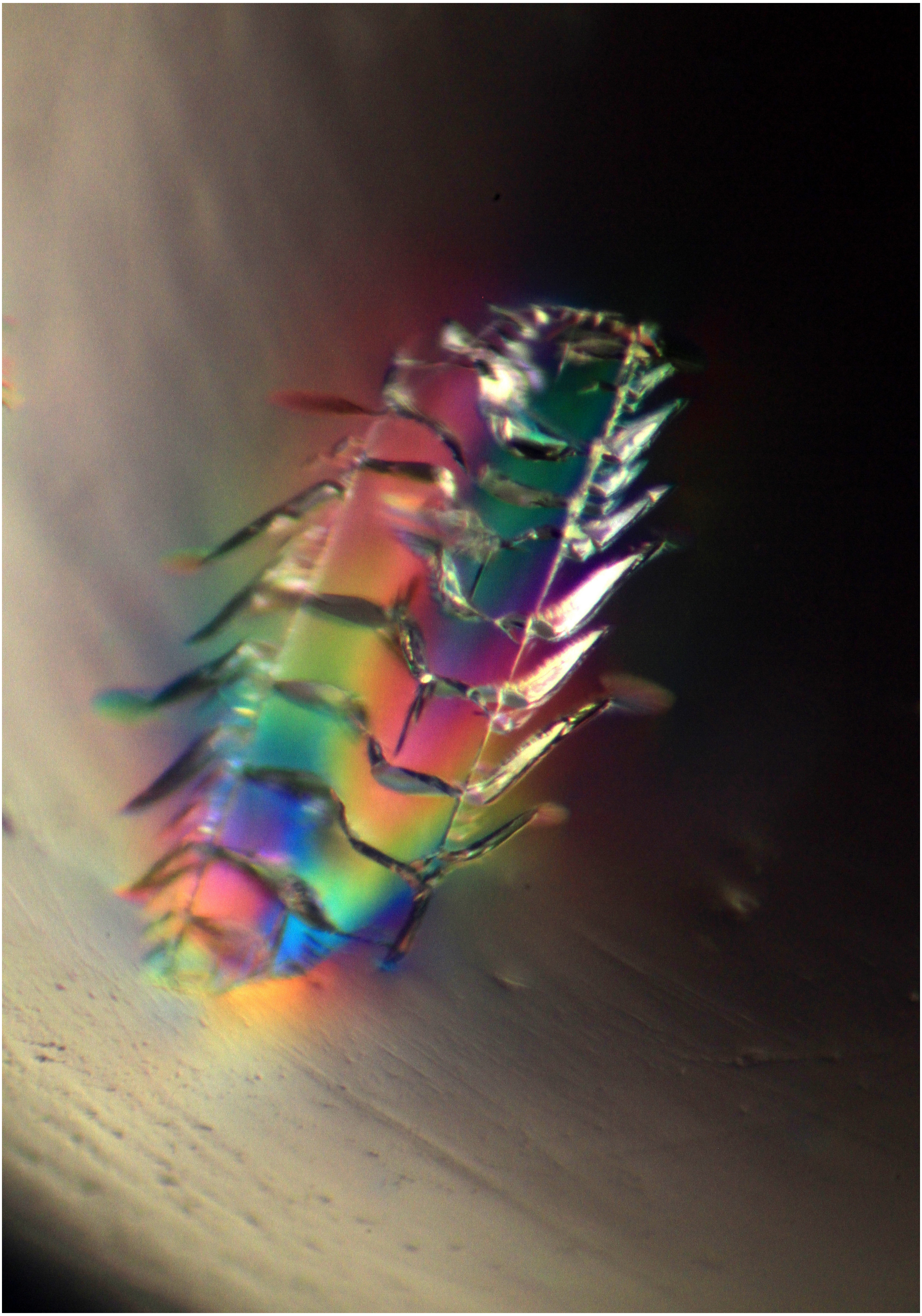

Trigons on a Diamond Crystal (Photo by Anthony de Goutiere)



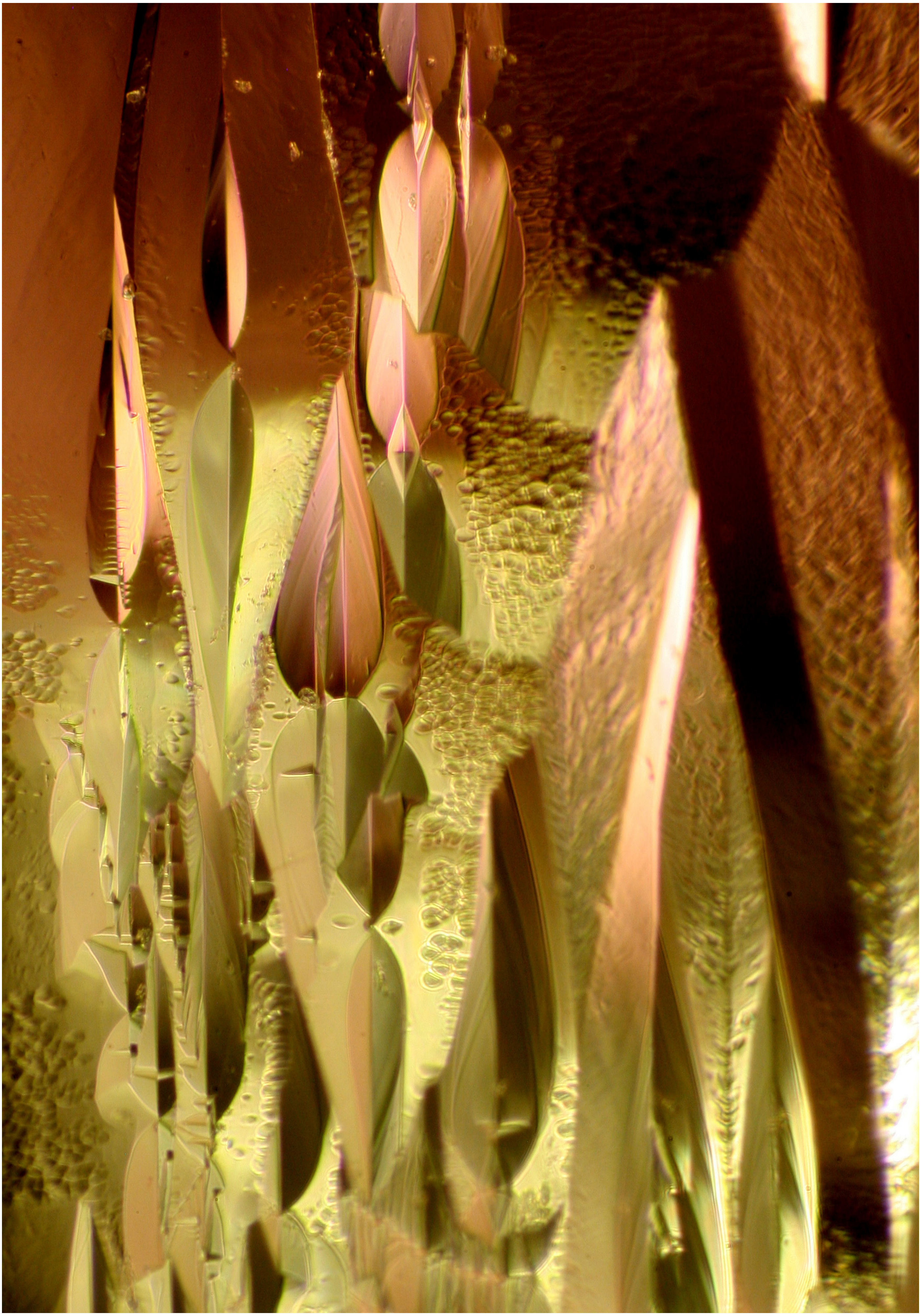
Hematite and Goethite in Amethyst Quartz (Photo by Anthony de Goutiere)



Diamond crystal in polarized light (Photo by Anthony de Goutiere)

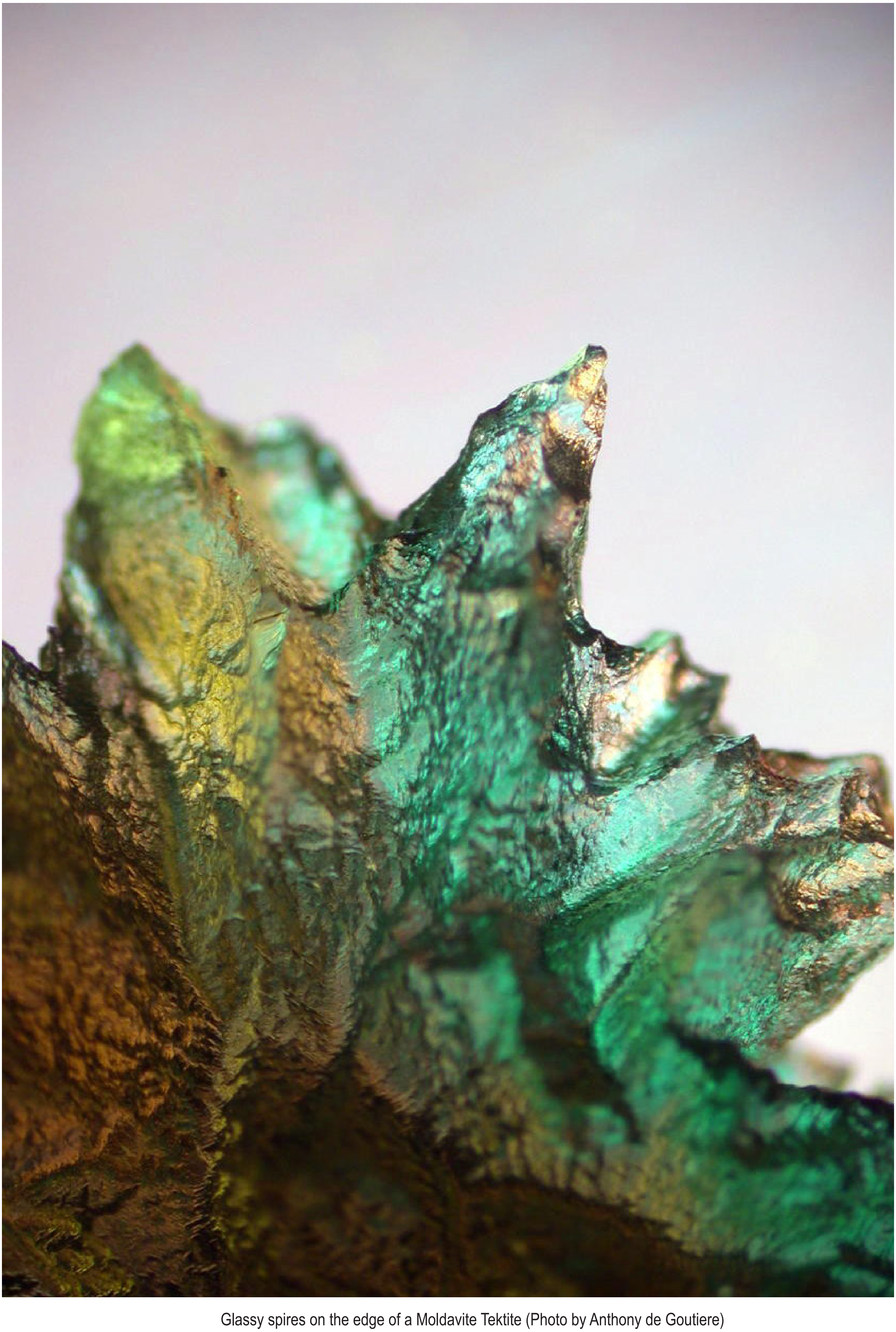


Cleavage and fracture ‘centipede’ in a Moonstone (Photo by Anthony de Goutiere)

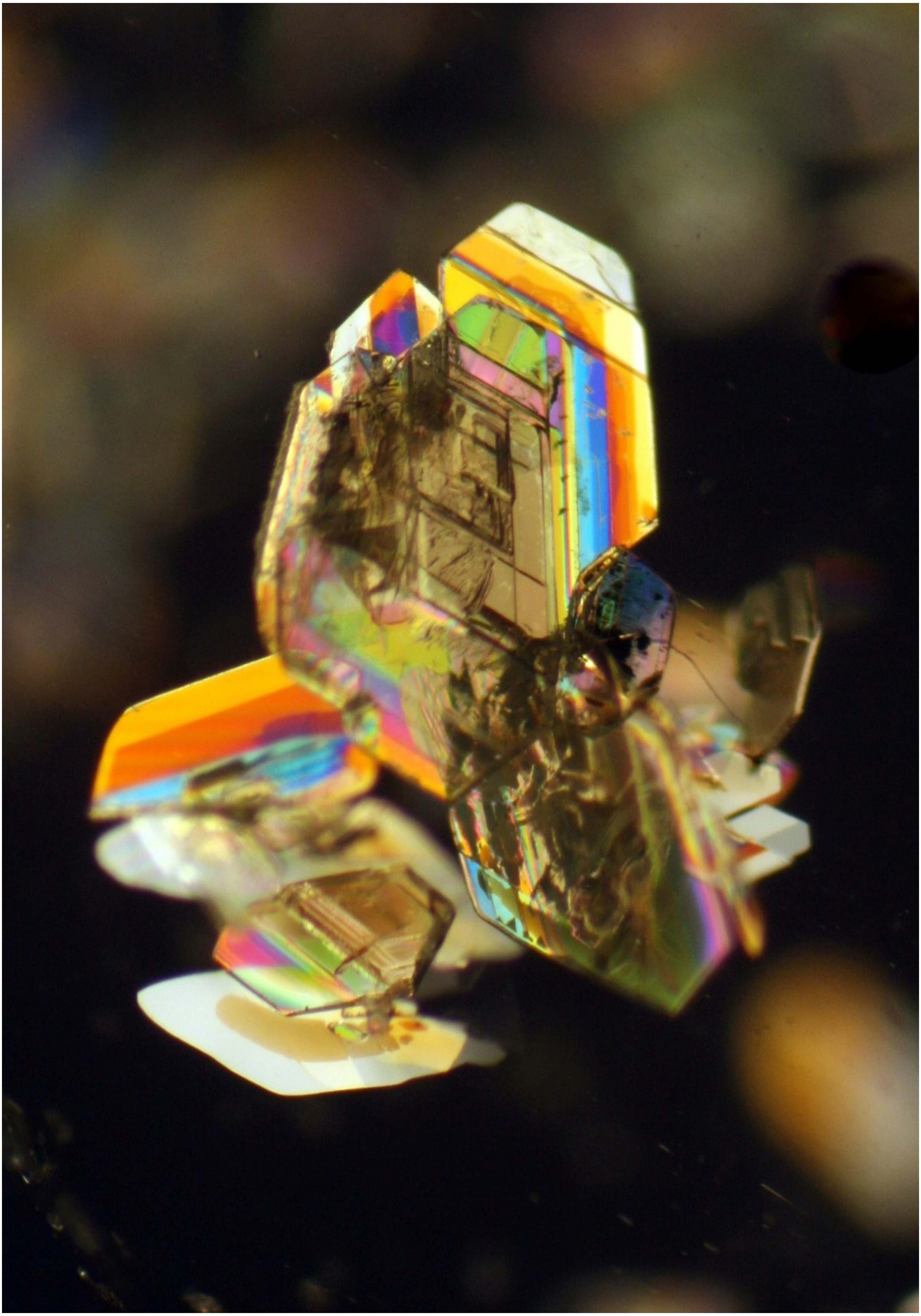


Surface of a Beryl crystal showing etching (Photo by Anthony de Goutiere)

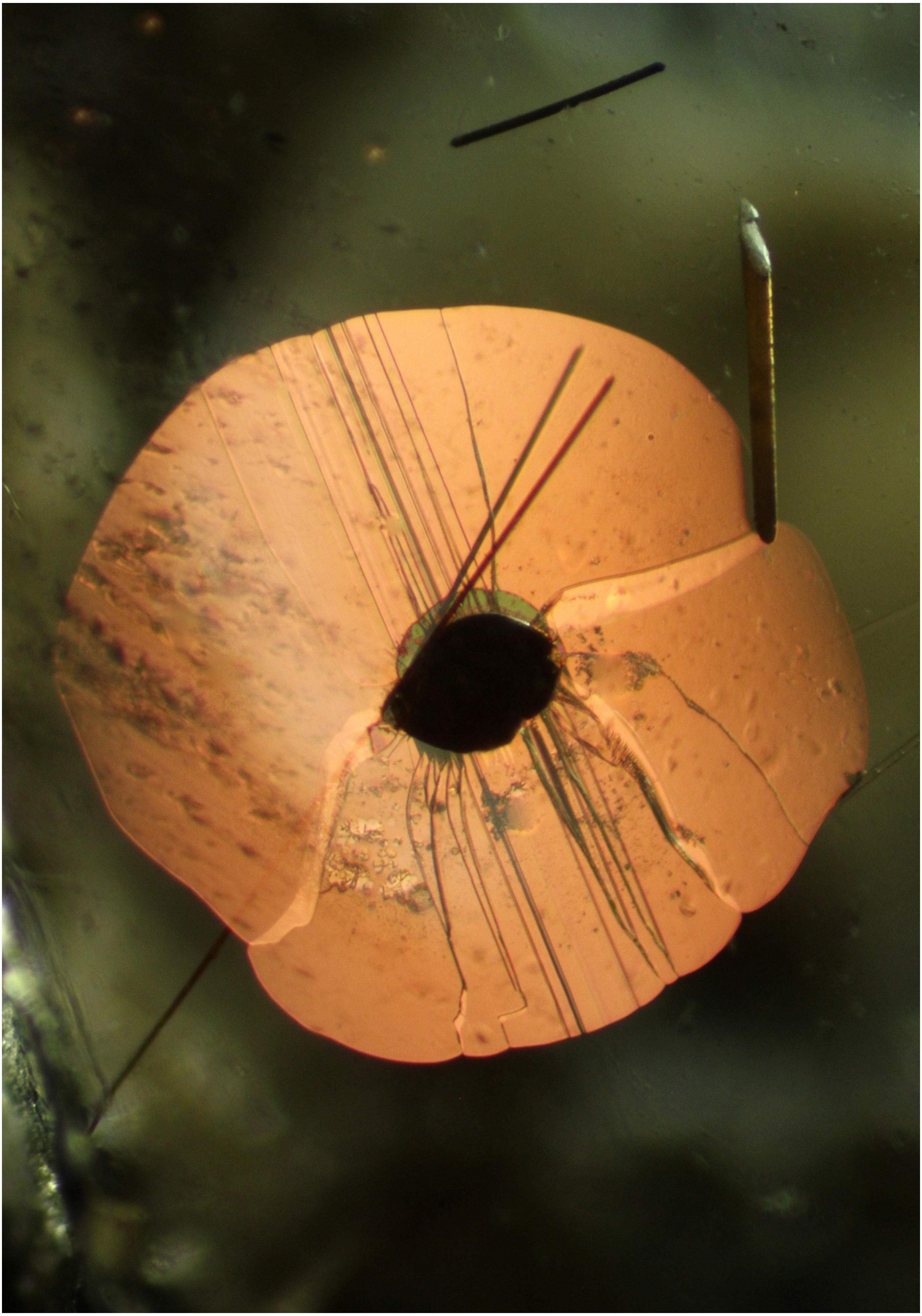
Etch features on a Beryl (Photo by Anthony de Goutiere)



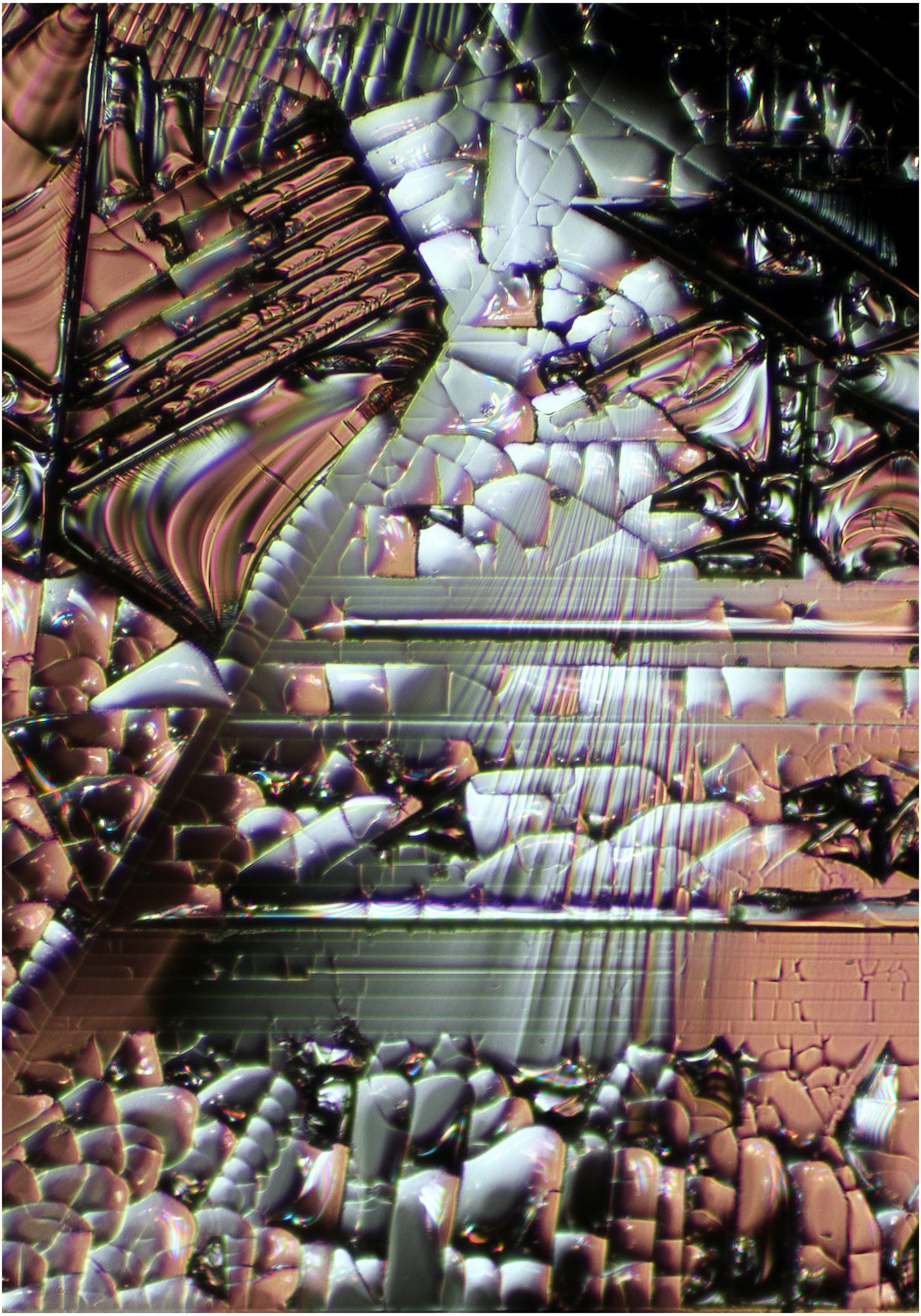
Glassy spires on the edge of a Moldavite Tektite (Photo by Anthony de Goutiere)



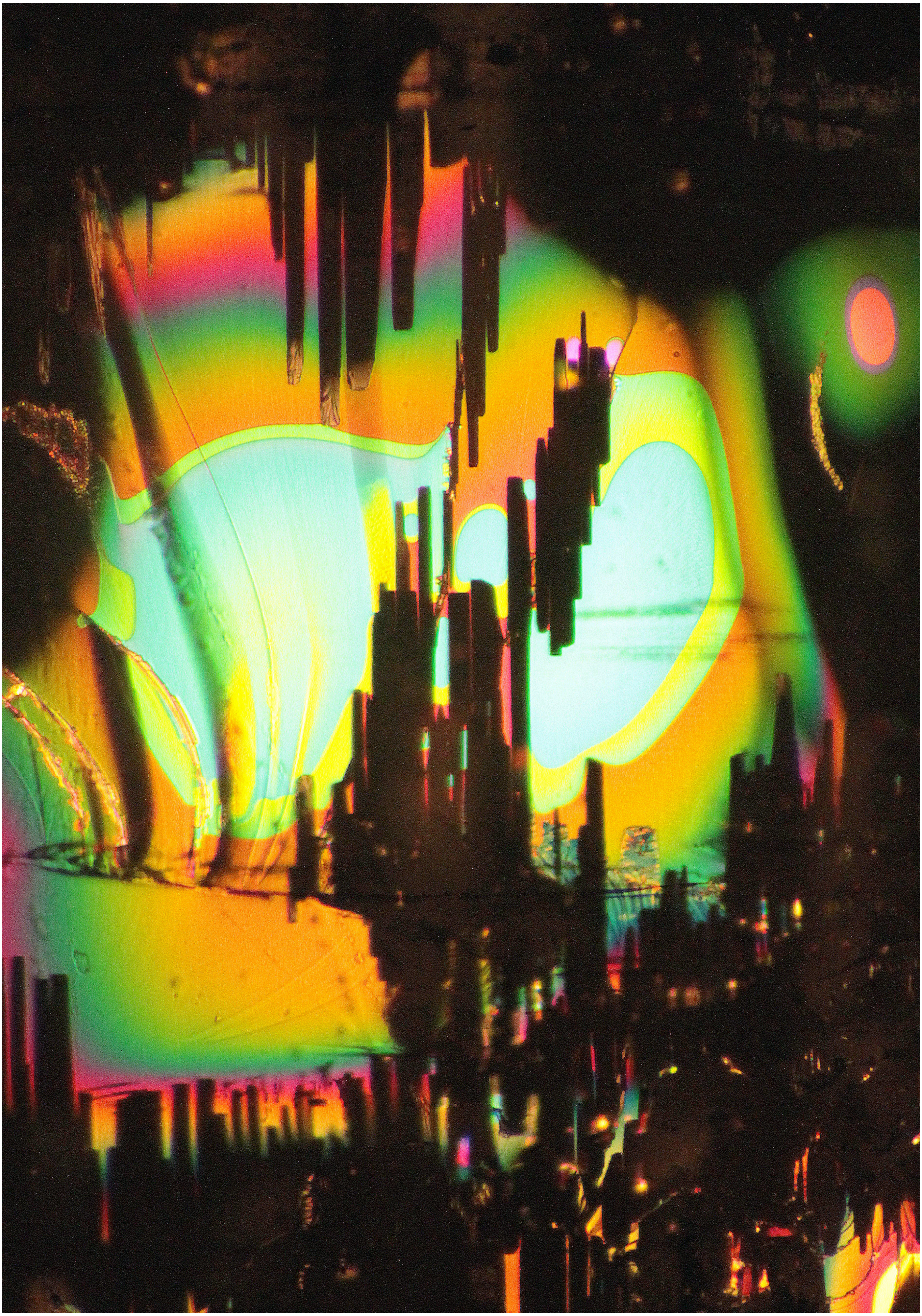
Muscovite Mica in polarized light in Beryl (Photo by Anthony de Goutiere)



Discoid ‘Lily Pad’ inclusion in Peridot (Photo by Anthony de Goutiere)

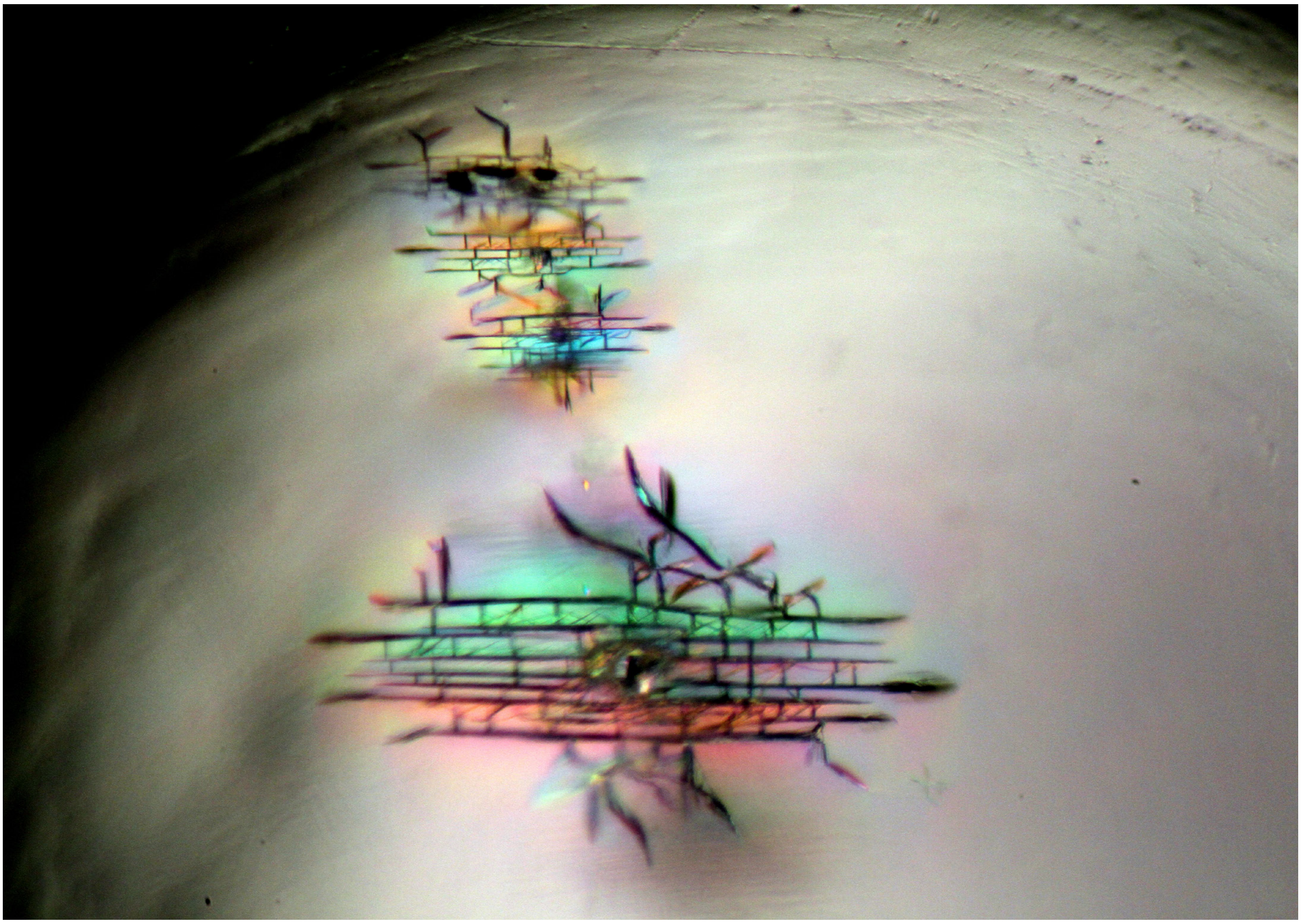


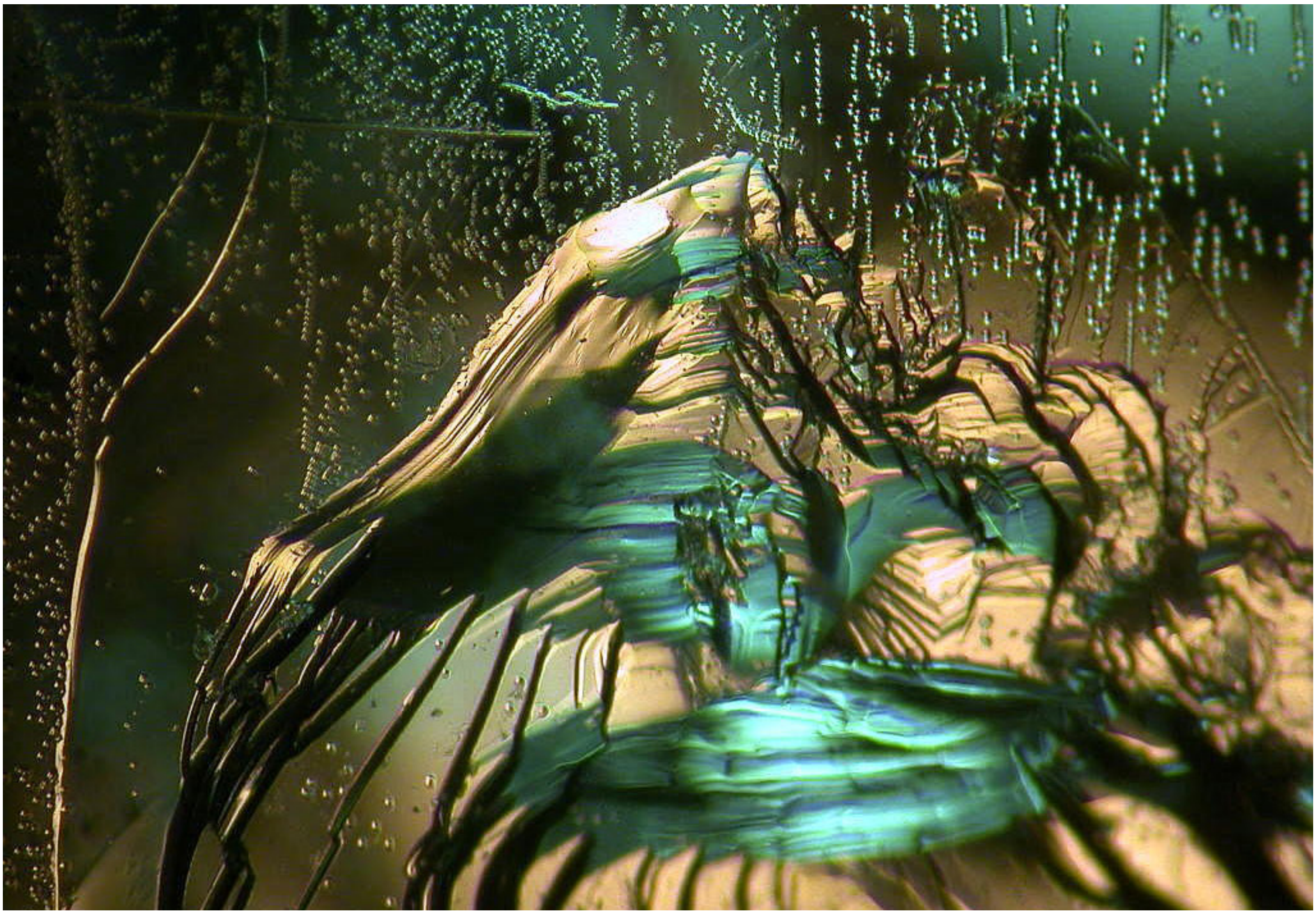
Surface tension on a crack in Tourmaline (Photo by Anthony de Goutiere)

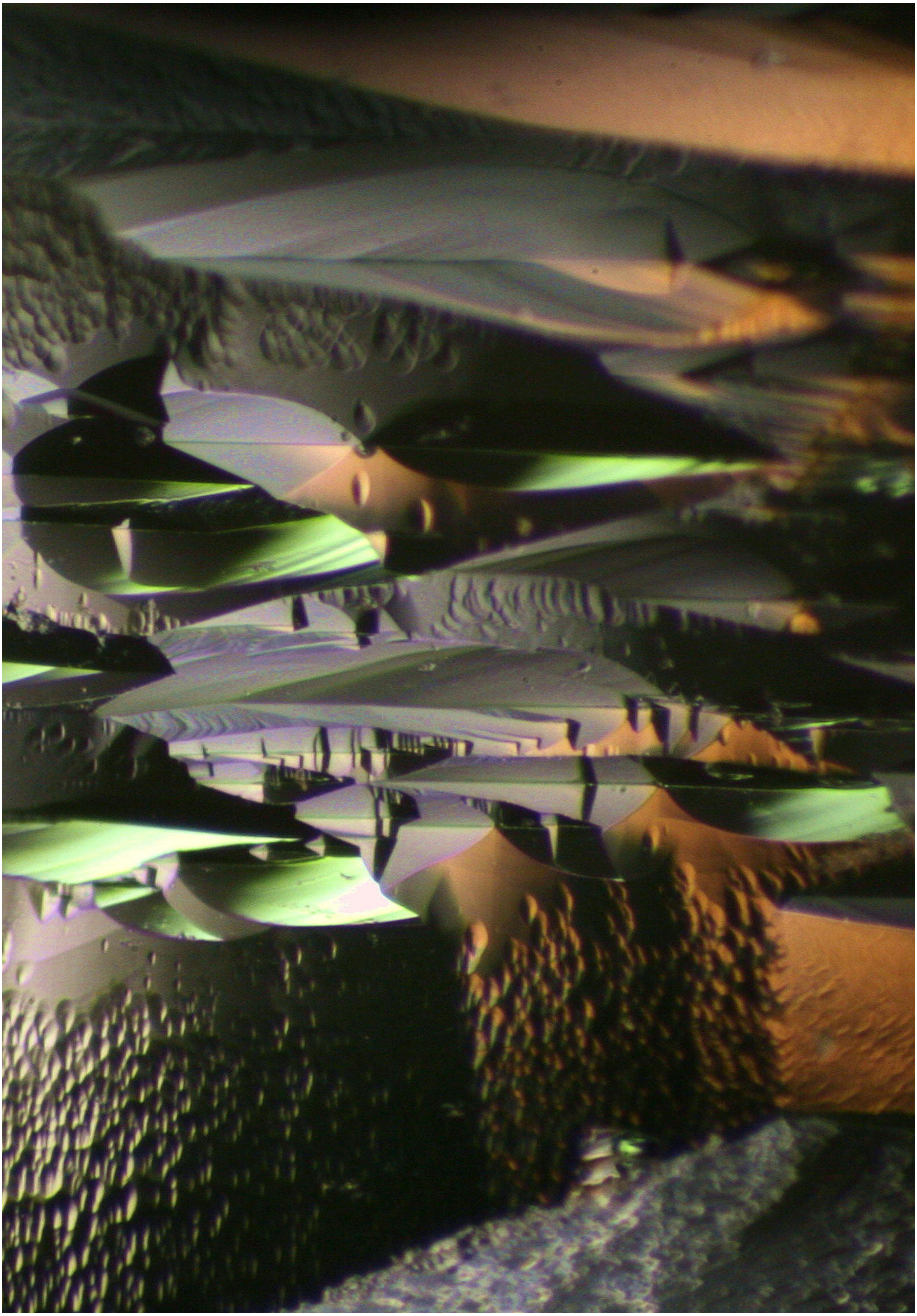


Thin film fluid inclusion in Beryl (Photo by Anthony de Goutiere)

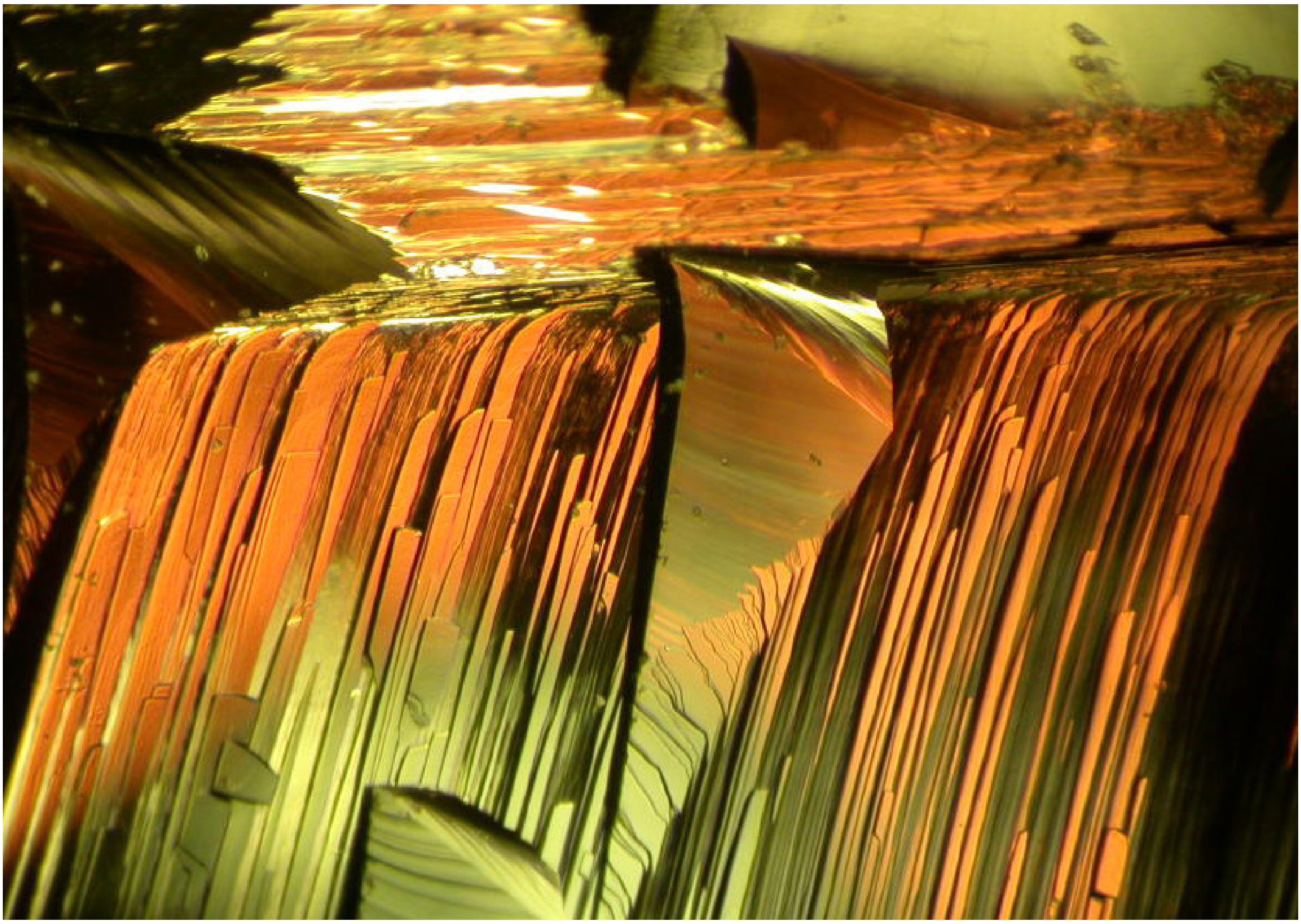
Thin film fluid inclusion in Beryl (Photo by Anthony de Goutiere)


Albite Inclusions in a Moonstone (Photo by Anthony de Goutiere)

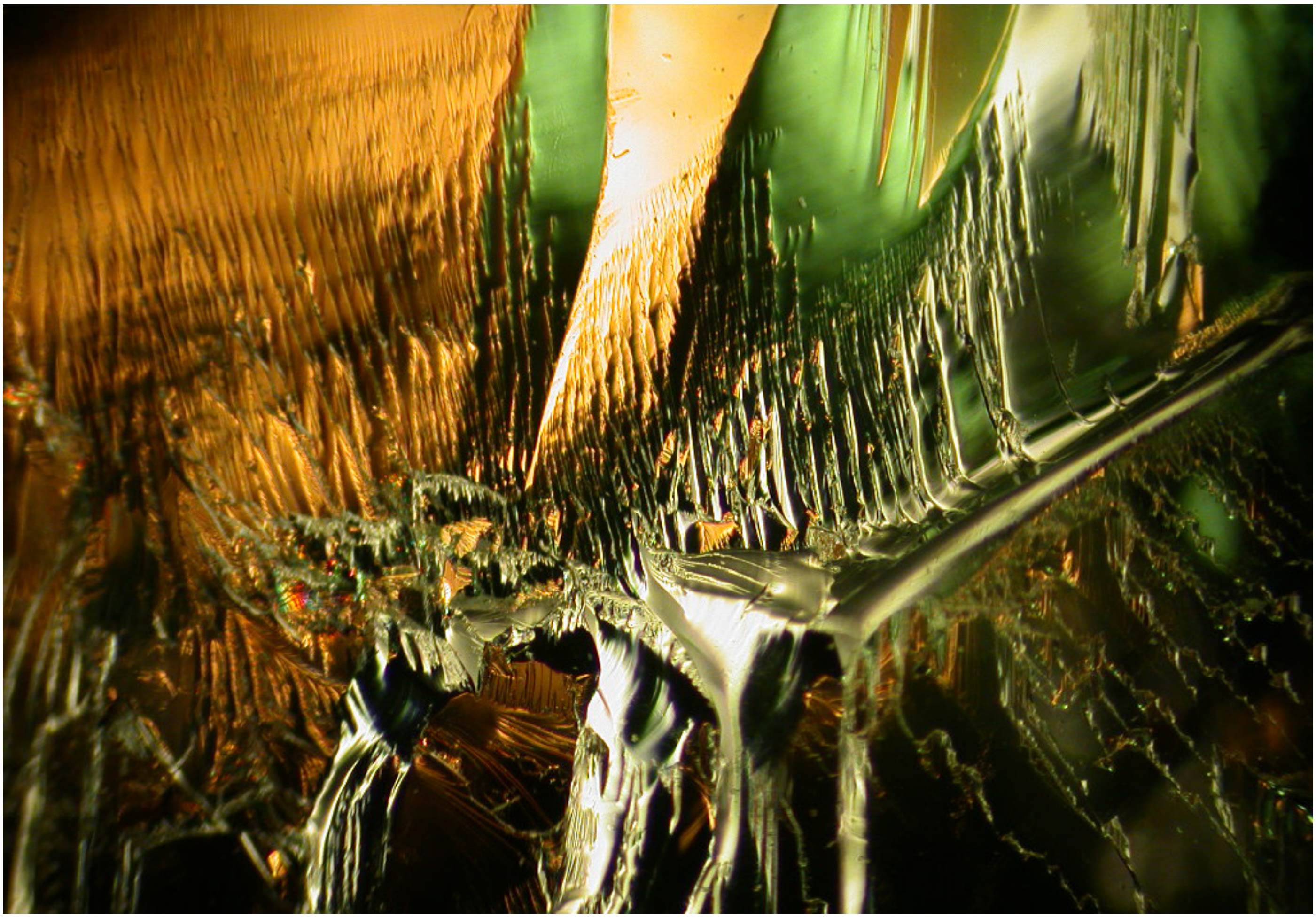

Surface features on a Topaz (Photo by Anthony de Goutiere)



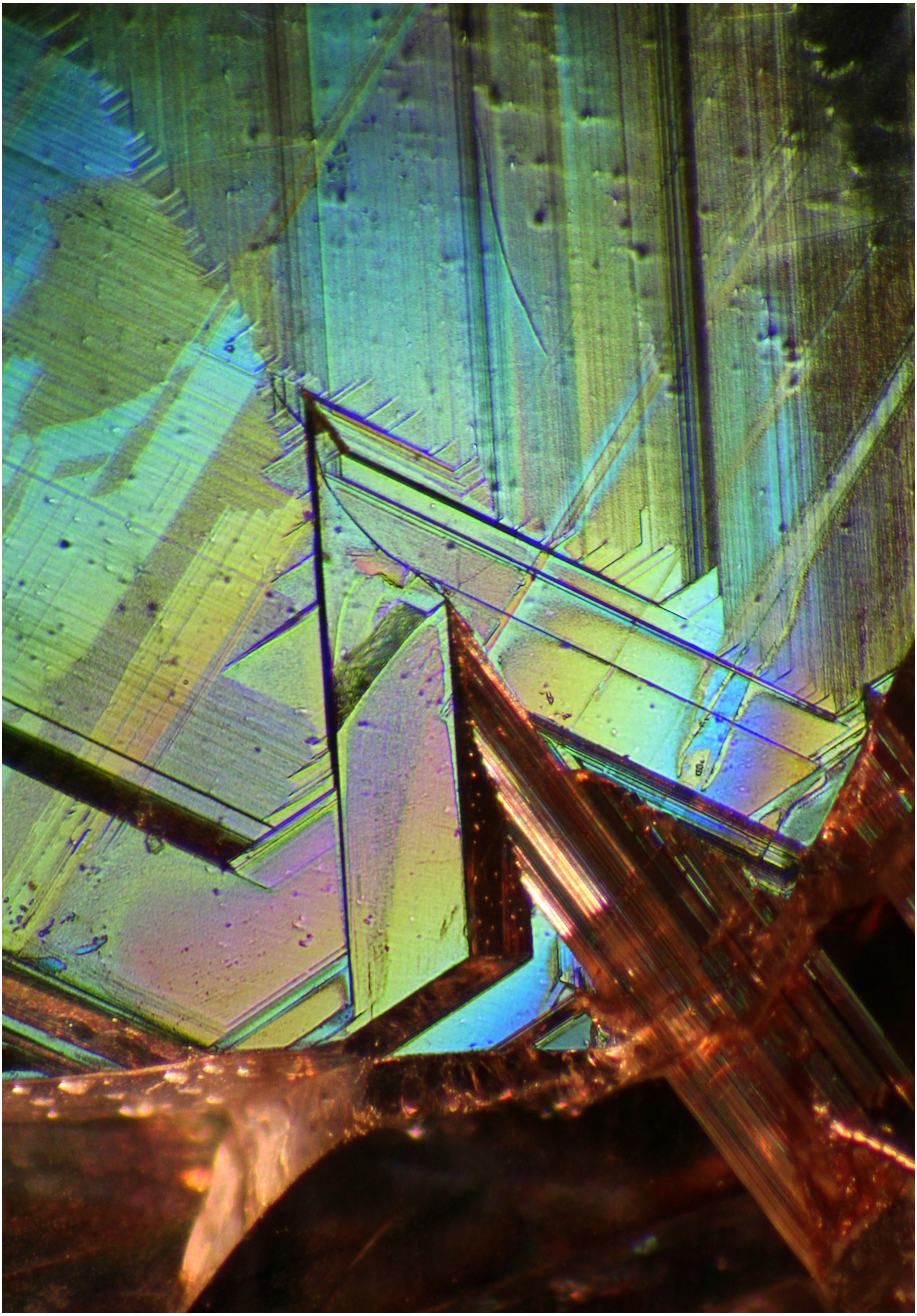
Surface features on a Beryl (Photo by Anthony de Goutiere)



Growth features on a Spodumene crystal which have the appearance of flowing lava – oblique illumination (Photo by Anthony de Goutiere)

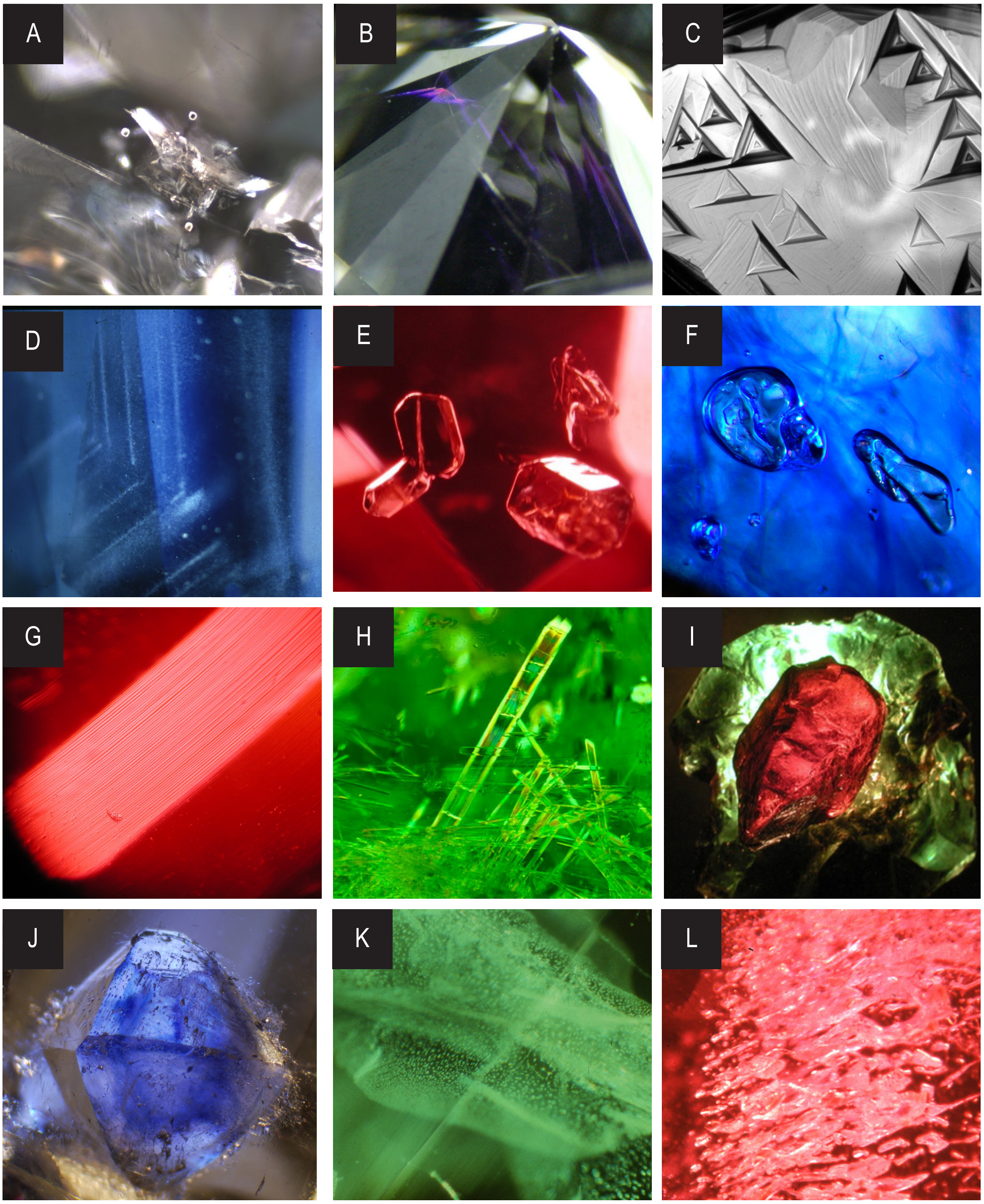


Small fracture surface on a Topaz crystal – oblique illumination (Photo by Anthony de Goutiere)



Hematite and the gold-coloured Rutile needles in a quartz crystal – oblique illumination (Photo by Anthony de Goutiere)

Gemmology Today Quiz #14



Trigons	Usambara Effect
Flux Inclusions	Laser Drilling
Fluorite Crystal	Apatite Inclusion
Gas Bubbles	Liquid Veils
Colour Zoning in Natural Corundum	Glass Filling
Amphibole Needle Inclusions	Curved Straie

In this issue, we want you to correctly match the twelve inclusion photos with the descriptions on the left.

Click ‘Start Quiz’, and then insert the correct answer for each ‘Letter’. Let’s see how you do!

START QUIZ

JEAN-MARIE ARLABOSSE is a chemist and gemologist. He is the owner of an independent gemological laboratory-free-structure (Gem Solid-Phase GemLab) located on the French Riviera in France. He was the creator and for fifteen years the animator - webmaster of www.geminterest.com"

Crystal Gazing - Magnesiotaaffeite

Figure 1 - Crystal to be Analyzed

Introduction

Having an extensive gem-material database of more than 300 mineral species including very rare ones (such as poudretteite and hibonite to name a few), allows us to provide a reliable gem-mineral identification for collectors and gem suppliers wishing to identify rough or cut gemstones.

Recently, a customer brought a flat orangey-pink crystal with a pearly lustre (Figure 1) to our attention. Although this translucent crystal looked like corundum, the owner felt the crystal needed a definitive identification.

Material and Method:

1. Sample: A 4.24 ct flat orangy-pink crystal with a pearly lustre (Figure 1).

2. Visible-NIR spectrometry obtained with an Ocean Optic USB 4000 spectrometer equipped with a home-made setting with an integration sphere. The software rendering was set in transmission %.

3. Fourier Transform Infrared (FTIR) spectrometry was performed with a Bruker Alpha spectrometer using a low noise DLaTGS detector, equipped with a diffuse (or specular in this case) reflectance type (DRIFT) signal capture module and was run at 4 cm^{-1} resolution.

4. Specific gravity was determined with a homemade set up involving a Dendritic gem scale.

5. Reactions to ultraviolet radiation (shortwave and longwave) were evaluated in a dark box lit with 6W UV tubes.

Results and Related Comments:

At first glance the crystal looked like a flat shiny corundum crystal.

Due to the fact that there were no polished or flat crystal faces, it was impossible to measure the refractive index on a standard refractometer.

Under the polariscope, the stone proved to be translucent with a constant light restoration (aggregated and/or strongly included and/or with strong abnormal polarization effect).

The measured specific gravity of 3.5 did not match the one we had expected for corundum (i.e. ~4.0).

Under SW ultraviolet light, the crystal displayed a medium chalky orangy-red fluorescence while under LW ultraviolet light, it exhibited a medium chalky reddish-orange fluorescence.

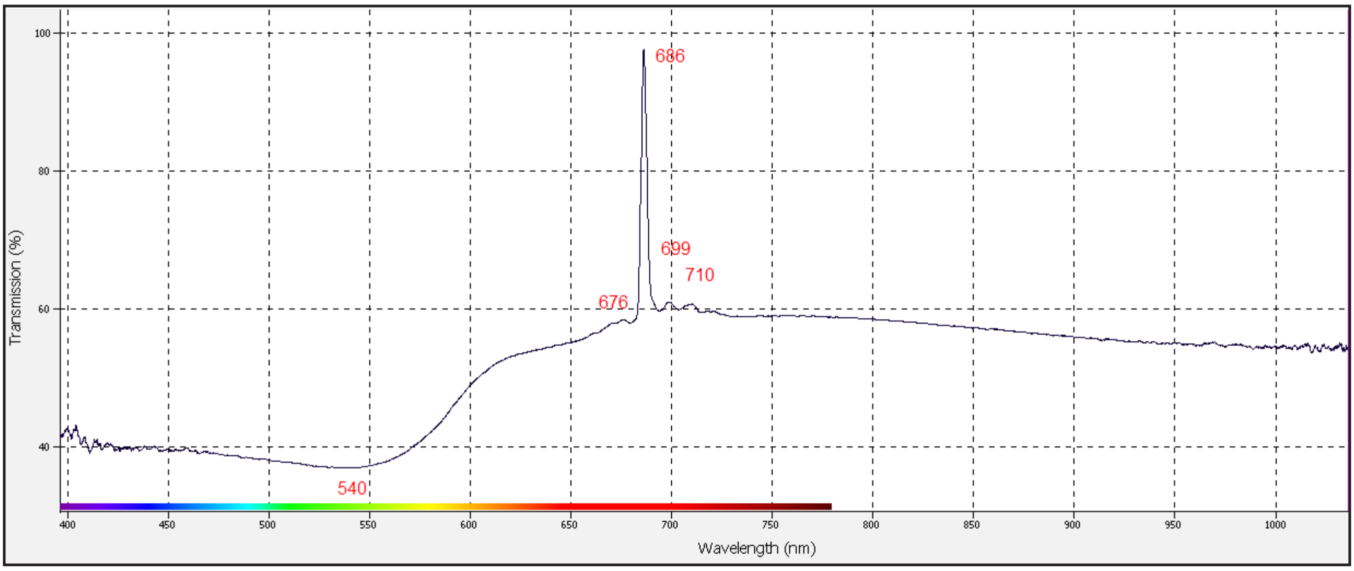


Figure 2 - Vis-NIR spectrum of the crystal

The absorption spectrum (Figure 2) showed a broad absorption band centered on 540 nm. Emission lines were also seen at 676, 686, 699 and 710 nm. Although this emission pattern was similar to the one found in chrome bearing corundum, the line's displacements did not match with those expected for corundum (chrome's emission lines in corundum are at 682, 694, 706 and 714 nm).

However when searching through our gem-material database (specular reflectance FTIR identification database) a perfect match was found with Magnesiotaaffeite (Figure 3).

This being said, a question arose during the evaluation process that the magnesiotaaffeite was actually the 2N'2S polytype (often named Taaffeite) or the 6N'3S polytype (often named Musgravite).

We are currently investigating the possibility of differentiating Taaffeite from Musgravite by the means of specular reflectance measurement since certain clues were found indicating that it could be possible to make this separation by this method. We now have to collect and analyze a statistically representative quantity of verified samples so as to validate this polytype separation method.

Conclusion:

The crystal has formally been identified as Magnesiotaaffeite.

This identification has demonstrated how important it is not to judge a stone by appearance alone. This case also demonstrates the importance of evaluating each peak displacement in the spectra without judging only the overall curve aspect.

Finally this study definitely demonstrates that several analysis methods must be used and their results cross-referenced in order to reach an accurate gem-material identification.

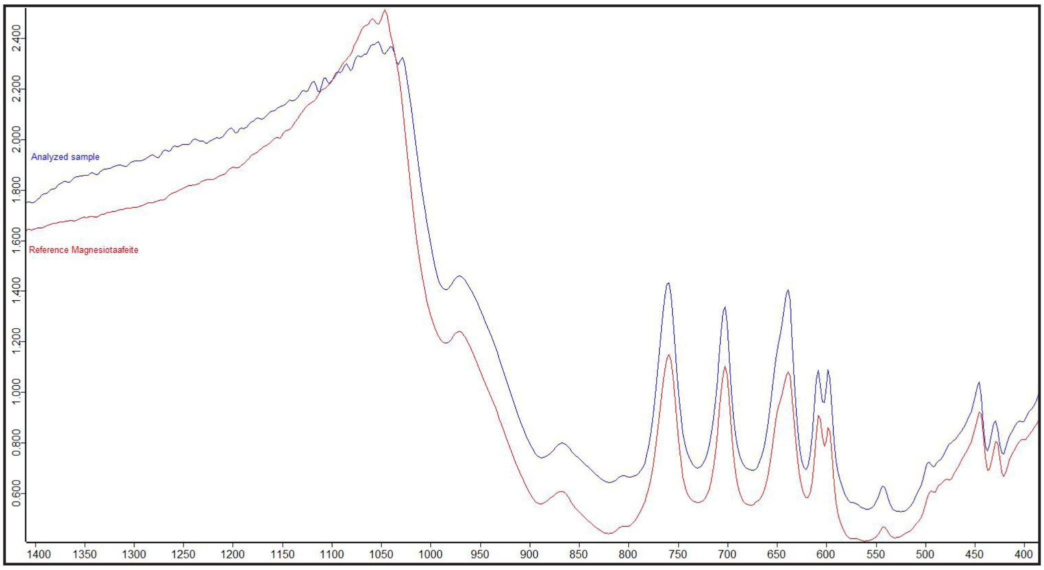


Figure 3 - FTIR specular reflectance spectrum of the crystal (blue trace) compared to the one of Magnesiotaaffeite reference (red trace). Measured spectra had a very good matching with the database references.

Money Cent$

Economics for Non-Economists

GEOFF DOMINY is an author, independent gemmologist and founder of the World Gem Foundation. He received his F.G.A through the Gemmological Association of Great Britain (Gem-A) in 1987 passing the diploma examinations with distinction.

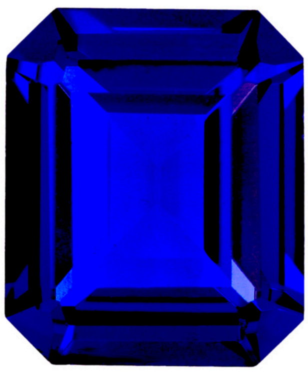
The Wealth of Experience

There is a lot to be said about experience. Experience is not a commodity you can buy. You cannot simply go online and find it. It does come at a price but that price is a combination of money and time spent acquiring it. It is what separates the men and women from the boys and girls. There is no substitute. It does not matter how smart you think you are, the rewards of experience cannot be disputed.

In the world of gemmology, experience plays an important role. While a student may be filled with an incredible amount of theoretical knowledge when they graduate, they lack experience. Of course they will have spent time working with stones but can 80 to 160 hours in a classroom environment really compete with over 30 years of hands-on experience?

Experience tells us what to look for and more importantly how to 'cut to the chase' without compromising the end result.

Take for example the blue stone below. To the untrained eye, it could be anything (well almost anything). To the trained eye, there are some very obvious options that immediately spring to mind.



We have all searched for items online. Whether it is a hotel room, an item of clothing or a diamond, typically we are exposed to 'filters' that allow us to refine our search. So if we are looking for a two-bedroom, two-bath rental through Airbnb, we can filter out all the properties that do not meet our criteria, while zeroing in on those that do.

I was recently searching the IDEX website for round brilliant cut diamonds for the World Gem Foundation study collection.

I had a long wish list that included a wide variety of clarities, colours, table %'s, crown angles, pavilion depth %'s, girdle thicknesses and finishes (polish and symmetry). Initially, my search was quite broad but as I filled each desired criteria, my search narrowed until I was looking for very specific diamonds.

As you can see from the graphics on the opposing page, by changing the search criteria from one parameter (carat weight) to eight (carat weight, colour, clarity, cut, certificate, price range and table %, my search went from 119,869 diamonds to 130 diamonds.

So what does this have to do with the science of gemmology?

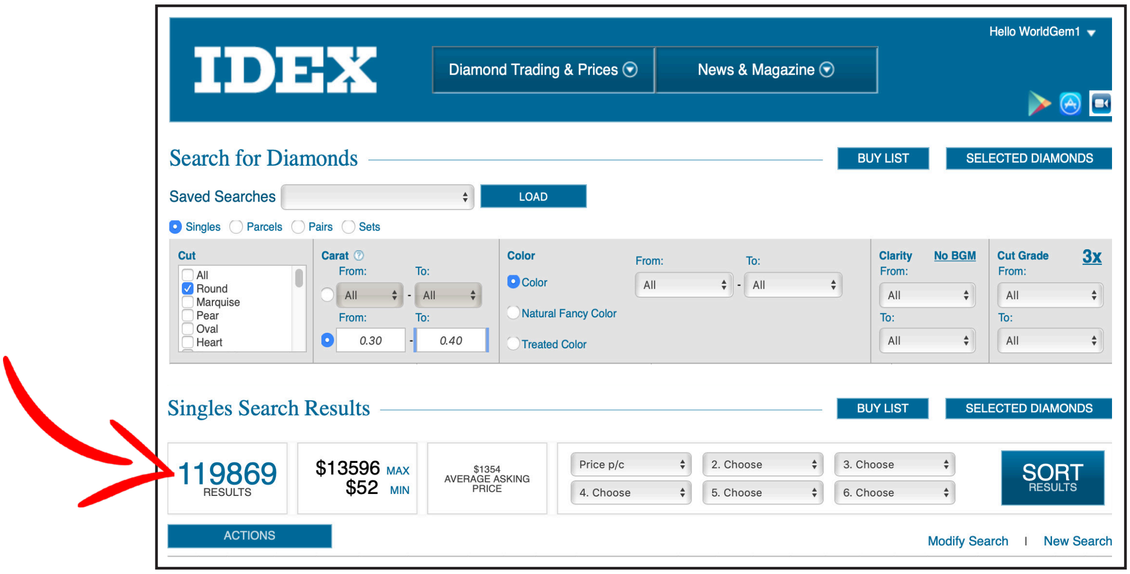
From Day One, the 'Mantra' of the World Gem Foundation has been 'to develop a research mentality' and to wherever possible 'replicate real life'. It is one of the cornerstones of our organization. As a seasoned gemmologist of 33 years, I would never accept a time restraint when identifying a gemstone nor would I accept not being able to consult my resource materials. The same is true of our students. I used to question 'open book' theoretical examinations but the reality is 'would anyone make an important decision based purely on their memory?' Absolutely not!

I am often asked why our Career Gemmology 'Gem Identification' module comes before our Diamonds and Coloured Gemstone modules. It is a fair question. After all, should you not know what you are identifying before you try to identify it?

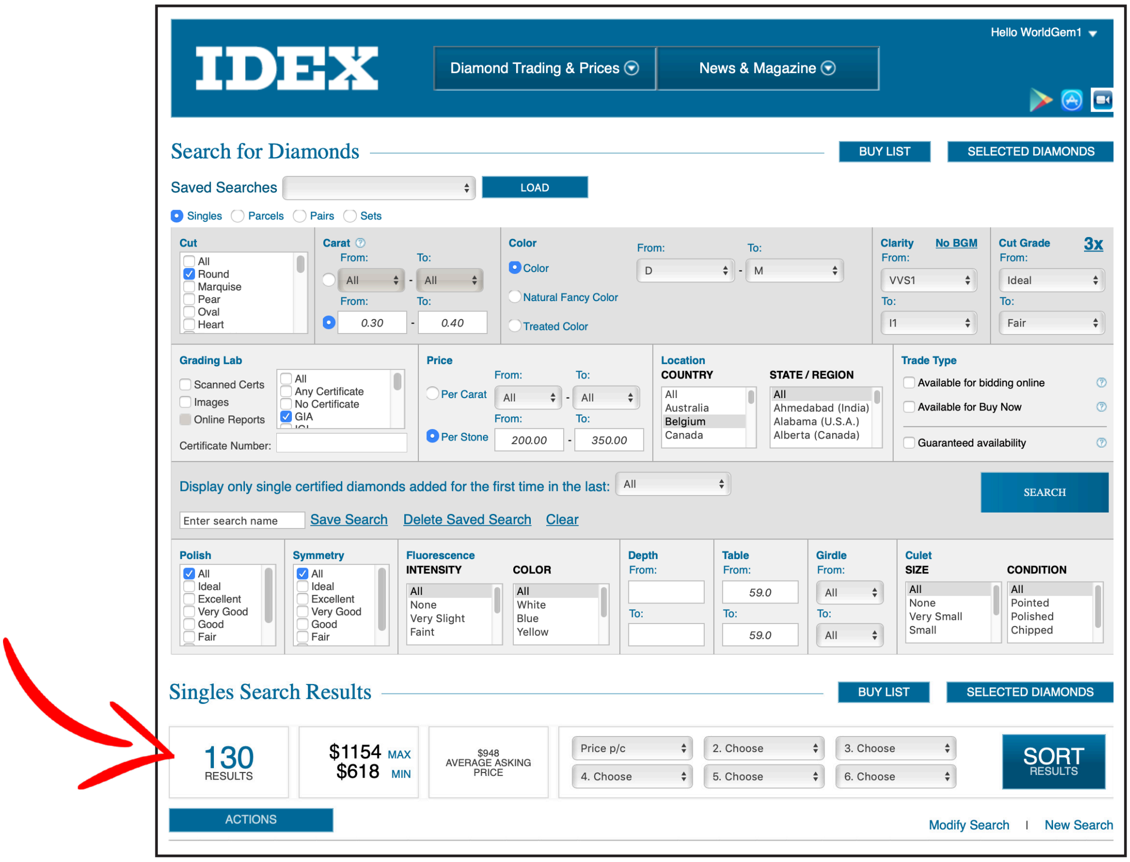
The answer again is 'Absolutely not!'.

Knowing what the options might be tends to prejudice the student. It creates bad habits, the tendency to cut corners and to sometimes try and fit square pegs into round holes.

Initial Search - 1 Parameter



Final Search - 8 Parameters



Let's go back to the blue stone. Experience tells me that the combination of colour, purity and cut screams 'lab-created blue spinel'. If I were asked to identify this stone, I would use a Chelsea Filter to confirm a 'red' reaction, pop it on a standard refractometer to confirm the 1.727 reading and then use UV light. In a matter of minutes, I am 99.99% sure I would make a correct determination. This is the reward of experience but to be honest, unless a student comes to us at a later stage in their life, it is a quality they simply will not possess.

By not knowing what the options are, it forces them to test the stone. To determine it's R.I., whether it is birefringent, uniaxial, biaxial, positive or negative. To determine its S.G, to observe how it reacts with a dichroscope or under different colour filters or UV light. If it has a diagnostic absorption spectrum or if there are any unique internal characteristics.

In essence what they are doing is setting up parameters (just like I did with IDEX) and filtering the possibilities of what a large dark blue stone might be.

Interestingly in our practical examinations and our preparatory practical tests, students have to record the tests they perform. A student may correctly identify 100% of the stones but if they do not document their tests, they will not get 100%.

I know......I can hear you saying 'But is that fair?'. Well the answer is 'Yes' and 'No'.

Imagine we are given another faceted blue stone. The logical place to start is with the refractometer since in an ideal situation, it will give us five very important pieces of information; the refractive index (including whether it is over the range of the refractometer or within the range), the birefringence, the optical character and the optical sign.

If it is over the range of a standard refractometer, the scale will appear uniformly dark. This in itself is important information because as we can see from Chart A, there are a limited number of blue transparent stones that have refractive indices above 1.79.

Let's assume that the refractive index of our 'unknown stone' is in the 1.62 range. If we look at Chart B, we can see that there are now eleven possibilities. One simple test has eliminated hundreds of potential candidates.

Now let's determine the optical character of the gemstone. This can be done on the refractometer, however I always like to confirm it using a polariscope. Let's assume that one shadow edge moves while the other remains stationary. This confirms that the stone is uniaxial (Chart C).

This now reduces the possibilities down to three but unfortunately, in this case, they are all uniaxial negative.

If we look at Chart D, we can see that the birefringence (double refraction) of tourmaline and smithsonite is considerably higher than apatite. Let's assume that in this case, the birefringence is noticeable but not dramatic.

Chart A

Gemstone	R.I. Range	D.R.	D	O/S	S.G. Range	H
Anatase	2.488 – 2.564	.046 – .067	–	U-	3.82 – 3.97	5 ½ – 6
Diamond	2.417 – 2.419	–	.044	I	3.50 – 3.53	10
Lab-created Diamond	2.417 – 2.419	–	.044	I	3.50 – 3.53	10
Irradiated Diamond	2.417 – 2.419	–	.044	I	3.50 – 3.53	10
Cubic Zirconia	2.15 – 2.18	–	.065	I	5.60 – 6.00	8 ½
Boleite	2.030 – 2.050	–	–	I	5.05	3 – 3 ½
Powellite	1.967 – 1.985	.011	–	U+	4.23	3 ½ – 4
YAG	1.83	–	.028	I	4.58	8 ½
Zircon	1.810 – 2.024	.002 – .059	.039	U+	3.93 – 4.73	6 ½ – 7 ½
Linarite	1.809 – 1.859	.050	–	B-	5.30	2 ½
Gahnite	1.791 – 1.818	–	–	I	4.00 – 4.62	7 ½ – 8
Garnet Doublet	1.770 – 1.820	–	.027	I	3.93 – 4.30	6 ½ – 7 ½

Chart B

Gemstone	R.I. Range	D.R.	D	O/S	S.G. Range	H
Lab-created Forsterite	1.634 – 1.670	.033 – .038	–	B+	3.22	7
Apatite	1.628 – 1.649	.002 – .006	.013	U-	3.16 – 3.23	5
Scorzalite	1.627 – 1.680	.038 – .040	–	B-	3.38	5 ½ – 6
Smithsonite	1.621 – 1.849	.228	.014	U-	4.00 – 4.65	5
Tourmaline	1.614 – 1.666	.014 – .032	.017	U-	3.01 – 3.11	7 – 7 ½
Hemimorphite	1.614 – 1.636	.022	.020	B+	3.30 – 3.50	5
Lazulite	1.612 – 1.646	.031 – .036	.014	B-	3.04 – 3.14	5 – 6
Topaz	1.610 – 1.620	.010	.014	B+	3.49 – 3.57	8
Pectolite	1.595 – 1.645	.038	–	B+	2.74 – 2.88	4 ½ – 5
Montebrasite	1.594 – 1.633	.220	–	B+/-	2.98 – 3.11	5 ½ – 6
Herderite	1.587 – 1.627	.023 – .032	–	B-	2.95 – 3.02	5 – 5 ½

Chart C

Gemstone	Uniaxial
Apatite	U -
Smithsonite	U -
Tourmaline	U -

Chart D

Gemstone	Birefringence
Apatite	.002 – .006
Smithsonite	.228
Tourmaline	.014 – .032

Chart E

Gemstone	Specific Gravity
Smithsonite	4.00 – 4.65
Tourmaline	3.01 – 3.11

Finally, to confirm our suspicions, let's do a specific gravity test. This results in an S.G. that it falls in the 3.05 range.

Based on this example, we would need four tests to confirm that the identity of the stone was tourmaline. The use of the refractometer (and polariscope) would point us in the right direction but based on the data we collected, we would still need to confirm the specific gravity if we wanted to be sure that it was tourmaline.

So if we had collected all this data and compared it to Chart B on the previous page, we can see that the physical and optical properties of tourmaline collectively are different to any other gemstone. This is what makes the identification of gemstones possible, the uniqueness of their physical and optical properties. However, it is important to remember that this uniqueness can only be highlighted if we increase the number of parameters or variables.

So going back to my original assertion that we do not want our students initially to know a great deal about the gemstones they are testing. Is it still possible to identify tourmaline even though they have never heard of it?

The answer is 'Yes'. Once you have collected the data (as we just have) and compare it to the tables of physical and optical properties, we will quickly see that other than certain lab-created gemstones (where their physical and optical properties can be identical to their natural counterparts), the more parameters we create, the less likely we are to find more than one gemstone that fits that criteria.

As a footnote, I should add that in addition to collecting data, it is essential to know when to spot certain 'anomalies'.

In the case of our test stone, one wrong test (perhaps we thought that the moving shadow edge had a higher R.I. than the stationary shadow edge and misdiagnosed it as being uniaxial positive instead of negative) could lead us on a very different path. This would have left us scratching our head because if we look at Chart B on the opposite page, we can see that there are no uniaxial positive gemstones in this refractive index range.

This is again where experience comes in. Knowing when the data you have collected is wrong and when you have to go over your test results again.

Gem testing is a combination of knowing the different gem testing instruments, what principles they are based on, what are their strengths and limitations and being methodical in how you collect the data.

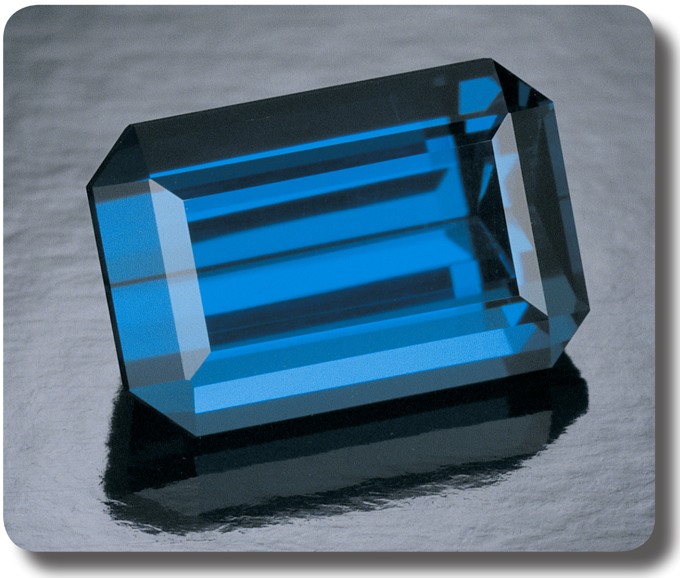
It is perhaps the area of gemmology I love the most. Identifying an inanimate object by a process of elimination.

As we have just seen, the list of eleven stones can quickly be reduced by systematically testing the stones. In this case, one instrument (refractometer) eliminated 73% of the possibilities (8 stones).

Selecting the right tools for the right job again boils down to experience. If the test stone had been cut en cabochon, the refractometer would not have yielded the desired results whereas the polariscope would have done.

This is what we teach at the World Gem Foundation. There is no point in having an arsenal of gem testing equipment at your disposable if you are continually shooting blanks.

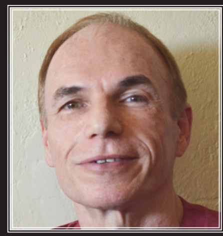
Creating good habits is essential when it comes to gem identification. Start out as you mean to go on, eliminating all possibilities until only one remains. You don't have to be personally acquainted with that stone.......numbers never lie.



Indicolite Tourmaline (Photo by Tino Hammid)

The Fingerprint File
GEM IDENTIFICATION

Something so simple and so effective yet often overlooked by gemmologists. Kirk Feral is a leading gemmologist and proponent of the use of magnetism in the identification of gemstones.



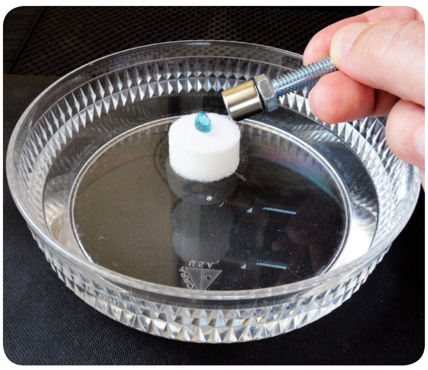
Slick Magnet

Can you identify a gemstone species or variety simply by looking at it? In some cases this is certainly possible, and the ability to discern subtleties in gem appearance is one of the most valuable skills a gemologist can master. But many natural gemstones look so similar to each other that identifying or separating them with the naked eye is a hopeless task, even for the most experienced gemologist.

Synthetic, imitation and treated gems also pose a challenge, as manufacturers continually strive to make these gems look just like their natural counterparts. When purchasing non-certified gems and jewelry, it's to our advantage to be able to verify the authenticity and correct identification of the gems ourselves. We can't rely on the seller to do this for us, as the seller may not have the knowledge or the time to test all items in their inventory.

Of the dozen or so standard instruments that gemologists can use to identify gems, the most portable and easy-to-use tools include a loupe, dichroscope, UV flashlight, incandescent flashlight, Chelsea filter, spectroscope and magnetic wand. Of these small tools, the magnetic wand is by far the most useful for separating gemstones.

Every gemstone displays some kind of response to a magnetic wand. Colored gems that are strongly paramagnetic respond directly to a magnet, while less paramagnetic gems and diamagnetic gems (repelled by a magnet) show responses that are visible when the gem is floated on a foam raft in water. Direct magnetic responses are limited by the weight of the gem, but magnetic responses shown during floatation are not.



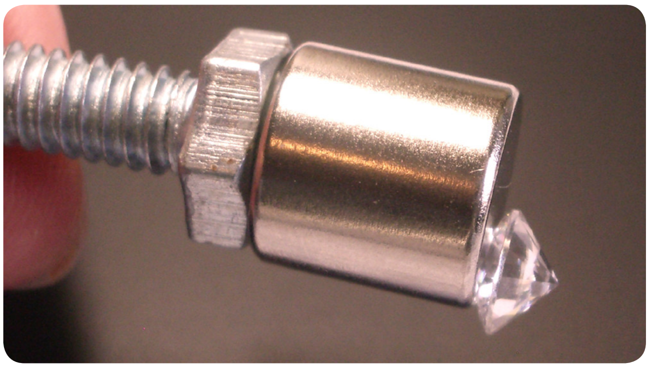
Gem Floatation

This article presents a number of examples of look-alike gems that can easily be separated with a magnetic wand made with a ½ " X ½ " cylindrical N52-grade neodymium magnet.

Natural Diamond and Synthetic Diamond

As the process of manufacturing lab diamonds becomes ever more economical, synthetic diamonds are appearing more frequently in jewelry and in parcels of natural diamonds. To the naked eye, synthetic diamonds can look exactly like natural diamonds, and they share the same optical and physical properties. Not even a diamond tester can spot a synthetic diamond.

But a magnetic wand can be immensely helpful. Of all HPHT (high pressure, high temperature) synthetic diamonds that I've examined, nearly 60% show some degree of magnetic attraction. Floatation is often required to detect a magnetic response, but some synthetic diamonds can be picked up directly by a magnet.



Direct Pick-up Response

Magnetic attraction in synthetic diamonds of any color is due to residual particles of ferromagnetic iron and nickel flux that become embedded within the crystal during the manufacturing process. Natural diamonds of any color, treated or untreated, are diamagnetic. They show no magnetic attraction when the floatation method is used, only a repel response. Any magnetic attraction therefor indicates the diamond is not natural.

This principle also applies to gems that imitate colored diamonds such as CZ (cubic zirconia) and YAG (yttrium aluminum garnet), which can show magnetic attraction when colored by metallic coloring agents such as rare earth elements. Unfortunately, in the case of synthetic diamonds made through chemical vapor diffusion (CVD), a magnet is ineffective. CVD synthetic diamonds contain no magnetic inclusions that might separate them from natural diamonds.

Red Garnet and Red Spinel

Red garnet gems such as pyrope, almandine and red spessartine garnet can look identical to red spinel gems, and all are singly refractive. We can of course use a refractometer to separate garnet from spinel, as the R.I. is always higher in red garnet. But a quicker and more efficient way to distinguish between these look-alikes is to use a magnetic wand.

Pyrope Garnet & Red Spinel

Red garnet contains enough iron to show a direct response to a magnet, and most red garnet gems are picked up by a magnet unless the gem is large and heavy. Rare exceptions are red chrome pyrope garnet, red pastel pyrope and red Mali garnet, all of which typically show a drag response to a magnet rather than a pick-up response. In contrast to all these red garnets, red spinel shows no response to a magnet until the floatation method is used.

Other red gems that can look almost exactly like red garnet but are separated by the absence of a direct response to a magnet are rubellite tourmaline, red zircon, red sunstone, treated red andesine, Madeira citrine, red fire opal and ruby. When identifying red gems, a magnetic wand is generally the first tool I reach for. This identification method is particularly useful for checking parcels of red gems.

Chrysoprase and Dyed Chalcedony

Genuine chrysoprase is chalcedony quartz that is naturally colored green by nickel. It can be quite a challenge to visually distinguish chrysoprase from dyed green chalcedony that has been made to look like chrysoprase.

A Chelsea filter will in some cases separate these gems. When incandescent light is applied, genuine chrysoprase remains green under a Chelsea filter, while some dyed chalcedony gems may appear white or pink. A more foolproof technique for detecting imitation chrysoprase is magnetic testing.

Chrysoprase & Dyed Chalcedony

Dyed chalcedony is always diamagnetic, showing a repel response when floated. In contrast, genuine chrysoprase when floated shows varying degrees of attraction to an N52 magnet due to sub-microscopic inclusions that contain nickel. The only chrysoprase that doesn't show magnetic attraction is very pale green or near-colorless chrysoprase.

Jade & Dyed Chalcedony

Another important example of dyed green chalcedony imitating another kind of gemstone is colorless chalcedony that has been dyed dark green. Such chalcedony is made to simulate green jadeite jade and nephrite jade. Fortunately, this fake jade is easily spotted with a magnet. Genuine green jade contains iron and always shows some degree of magnetic attraction when floated. Dyed chalcedony is diamagnetic.

Jadeite & Dyed Chalcedony

And unlike natural jade, phony jade objects made from man-made resins or glass are also diamagnetic. Even large jade carvings, whose authenticity can't be checked by refractive index or specific gravity, can be tested for magnetism via floatation.

However, magnetic response cannot distinguish natural jade that has been dyed or impregnated with polymer from untreated jade, as both are paramagnetic. Likewise, some untreated gemstones that look like jade such as serpentine and dark green chrysoprase are quite paramagnetic and can't be separated from jade by magnetic response.

Turquoise and Imitation Turquoise

Turquoise is one of the most imitated gemstones. Fabricated turquoise imitations can be made of glass, ceramic, porcelain, plastic, dyed howlite or dyed magnesite, and dyed bone or ivory. Our options for identifying genuine turquoise are limited due to the gem's opacity and absence of facets. But here again a magnetic wand is indispensable, as magnetism easily distinguishes natural turquoise from all these imitations.

Natural Turquoise & Imitation Turquoise

Natural turquoise always shows some degree of magnetic attraction when floated due to the copper salts that give genuine turquoise its distinctive blue color. All turquoise imitations that I know of are diamagnetic. Unfortunately, a magnetic wand can't reveal whether genuine turquoise has been dyed or reconstituted.

Chrome Tourmaline and Green Tourmaline

Regardless of the species of tourmaline (elbaite, dravite, uvite, liddicoatite), most transparent tourmaline gems have the same physical and optical properties. Without advanced instruments, we generally can't distinguish one species or variety of gem tourmaline from another except by color.

In the case of chrome tourmaline (dravite species) and green verdelite tourmaline (elbaite species), both are green, with color saturation ranging from light green to dark green. Although chrome tourmaline tends to have richer green color than verdelite tourmaline, differences are not always obvious. So how do we definitively distinguish between these two tourmalines? The distinction is important, as chrome tourmaline is rarer and typically much more valuable than verdelite tourmaline.

Chrome Tourmaline & Verdelite Tourmaline

One quick way to separate these gems is by magnetic response. Because verdelite tourmaline is colored by iron, it always shows some degree of magnetic attraction, and verdelite gems with dark green color typically show a drag response to a magnet with no need for floatation. On the other hand, chrome tourmaline is colored by small amounts of vanadium and chromium. Chrome tourmaline never shows a direct response to a magnet, and in most cases it is diamagnetic when the floatation method is used.

Another simple and useful tool for making a distinction between these tourmalines is a Chelsea filter. Chrome tourmaline shows a pink or red reaction under a Chelsea filter, while verdelite tourmaline remains green.

Aquamarine and Blue Topaz

Although aquamarine beryl and blue topaz are two different species of gemstone, one species can easily be mistaken for the other. Both gems can be free of inclusions and have light blue color. The pure light blue to moderate blue color seen in most aquamarine gems, without the innate green component common to untreated aquamarine, is obtained through heat treatment. Blue topaz is a much more common gem, and its pure light blue and moderate blue ('Swiss' blue) colors are typically the result of radiation treatment.

Aquamarine & Blue Topaz

A handy way to separate these blue gems is with magnetic testing. Aquamarine is colored by iron, and shows weak to moderate magnetic attraction during floatation (unless the aquamarine is near-colorless). Blue topaz gems derive color from color centers, and never show magnetic attraction. Topaz as a species is diamagnetic, regardless of color or treatment, except in the rare case when a large paramagnetic inclusion is present.

Natural Blue Spinel and Synthetic Blue Spinel

Synthetic spinel made by the flame fusion method is one of the more common man-made gems. Although blue color in lab spinel often appears artificial, at times it's hard to know for sure if a blue spinel gem is synthetic or natural without testing. Fortunately, a number of tools can definitively separate blue synthetic flame fusion spinel from natural blue spinel: a refractometer, thermal inertia meter, UV flashlight, Chelsea filter and magnetic wand.

Natural Spinel & Synthetic Spinel

Separation with a magnetic wand is simple. Without exception, natural blue spinel shows some degree of magnetic attraction, with the response ranging from weak to strong when floated. This is because natural blue spinel is colored predominantly by iron (except in the rare case of cobalt spinel).

As a rule, synthetic blue spinel produced by the flame fusion process is diamagnetic. Synthetic blue spinel is colored by a trace amount of cobalt, which creates pure blue color without the gray tones typically seen in natural spinel.

An even faster way to separate natural from synthetic blue spinel is with the help of a 365nm UV flashlight. Under longwave UV light, synthetic blue spinel (flame fusion or flux-grown) fluoresces pink or red due to cobalt, while natural blue spinel doesn't fluoresce. This separation method is great for testing parcels of blue spinels and blue spinels set in jewelry.

Two rare exceptions to separating gems by fluorescence are natural cobalt spinel and natural spinel treated with cobalt diffusion. Both of these unusual gems derive blue color primarily from cobalt, and both fluoresce red under a UV flashlight like synthetic blue spinel.

A rare exception to separation by magnetism is blue synthetic flame fusion spinel that contains just enough manganese (in addition to cobalt) to cause faint magnetic attraction. Such a manganese-rich synthetic blue spinel is easily spotted by its yellow-green fluorescence (instead of red) under longwave UV light.

Demantoid Garnet and Tsavorite Garnet

These green garnets represent two different species: andradite and grossular. Both garnets are highly desirable and valuable due to their gorgeous green colors. The color of green andradite and green grossular garnets ranges from light green to dark green, with darker green colors driven by higher concentrations of chromium and vanadium respectively. However, the finest demantoid gems with rich green color demand much higher prices per carat than dark green tsavorite gems due to demantoid's greater brilliance and rarity.

Demantoid Garnet & Tsavorite Garnet

The fastest way to separate these two types of green garnet is to use a magnetic wand. Demantoid garnets are highly paramagnetic, and gems are easily picked up by an N52 magnet. In contrast, tsavorite garnets contain much less iron and show magnetic attraction only when the floatation method is used.

Demantoid Garnet & Green YAG

Man-made YAG (yttrium aluminum garnet) with light green to dark green color makes an excellent imitation of light or dark green demantoid garnet. To the unwary buyer, a YAG impostor could be deceptively sold at steep prices as a demantoid garnet. Demantoid garnet and the man-made imitation are both singly refractive and over the limit of refractometer fluid (OTL), so testing for distinctions between these gems can be tricky. Even thermal inertia fails to separate these gems, as readings for both are very similar.

Demantoid Garnet & Green YAG

But we're in luck. With the help of a magnet, determining whether a gem is demantoid or YAG is effortless. As we have indicated, demantoid gems are picked up directly by a magnet. Green YAG must be floated in water for any magnetic response to be visible.

Other green gems that could be mistaken for demantoid garnet because of high brilliance and dispersion or an R.I. that is OTL are green Mali garnet, chrome sphene and green zircon. These gems are also easily separated from demantoid via magnetic testing. Unlike demantoid garnet, Mali garnet shows only a drag response to a magnetic wand. Zircon and sphene require floatation in order for any paramagnetic or diamagnetic response to be visible.

Orange Spessartine Garnet and Hessonite Garnet

Orange spessartine garnet is prized for its brilliance and dazzling color. Hessonite garnet is an orange variety of grossular garnet that is generally less brilliant and less valuable than gems of the spessartine species. But both species of orange garnet can be equally beautiful, and based solely on appearance, a hessonite garnet can easily be mistaken for a spessartine garnet.

Spessartine Garnet & Hessonite Garnet

Gemologists often rely on a refractometer to separate these garnets, as hessonite has a much lower R.I. than orange spessartine, which is often OTL. But we can bypass the refractometer and distinguish between these garnets more quickly by using our magnet.

As a result of a high concentration of manganese, spessartine is the most magnetic of all garnet gems. It shows a pick-up response unless it's large and heavy. Hessonite is much less magnetic. Hessonite gems with light 'imperial' orange color must be floated in order for any magnetic attraction to be visible. Hessonite gems with dark 'mandarin'" orange color are a bit more magnetic and can show a drag response to a magnetic wand without floatation, but no pick-up response is possible unless the hessonite gem is very small (under 1/3 ct.).

Two other gems whose appearance can closely resemble orange spessartine garnet are orange sapphire and orange dravite tourmaline. Magnetic response also distinguishes these gems from spessartine. The magnetic responses of orange sapphire and orange tourmaline can only be seen when the floatation method is used.

Natural Sapphire and Synthetic Sapphire

Sapphire gems belong to the corundum species, along with rubies. Both natural sapphires and synthetic sapphires share the same physical and optical properties, and separating one from the other can at times be challenging. Natural sapphires are found in a variety of colors besides blue, and in the gem trade, non-blue sapphires are referred to as fancy sapphires. Synthetic sapphires produced by the flame fusion method are very common, and they're manufactured in all colors to mimic natural sapphires and many other types of natural gems.

Natural Sapphire & Synthetic Blue Sapphire

To separate natural from synthetic sapphire, we can use magnification to look for natural inclusions or angular color zoning as an indicator of natural origin, or check for differences in longwave and shortwave UV fluorescence. But one of the most convenient and definitive separation methods is magnetic testing. Any magnetic attraction when the floatation method is used is proof that a sapphire is natural, whether the sapphire is blue or some other color.

All synthetic sapphires made by the flame fusion method are diamagnetic, regardless of color. In contrast, the majority of natural blue sapphires and fancy sapphires contain enough iron to show some degree of magnetic attraction. However, low-iron natural sapphires from certain localities such as Sri Lanka, Myanmar and Tanzania can show a diamagnetic response just like synthetic sapphire.

An uncommon exception to diamagnetism in lab sapphire can be found in flux-grown blue sapphire. Flux-grown sapphires are grown over many months into hexagonal crystals that have a somewhat natural appearance. A flux-grown synthetic blue sapphire may contain residual metallic flux inclusions that cause magnetic attraction, mimicking the response of natural blue sapphire. Flux-grown sapphire can also show unequal color distribution that resembles natural color zoning. Fortunately, the synthetic nature of flux-grown blue sapphire is readily revealed under longwave UV light if yellow-green fluorescence is observed.

An Invaluable Tool

In a few instances, the response that a gem shows to a magnetic wand can by itself provide a positive identification, with no other test required to distinguish a gemstone from all other species or varieties. For example, dark blue indicolite tourmaline is the only blue gem of any kind (natural or man-made, transparent or opaque) that can show a drag response to an N52 magnet. And demantoid garnet is the only natural transparent green gemstone heavier than 3/4 carat that can be picked up by a magnet.

The examples I've shared in this article represent only a fraction of the many look-alike gems that are quickly separated via magnetic testing. Using a magnetic wand, you can discover for yourself many other examples that will aid in gem identification. For a comprehensive list of magnetic responses in gemstones, see the Magnetic Susceptibility Index on my website gemstonemagnetism.com.

Article Submissions

The deadline for the next issue is

May 15th, 2020

Guidelines:

- We do not accept highly scientific articles. These are better suited for either the Journal of Gemmology or Gems & Gemology
- All articles should be a minimum of one page.
- All accompanying photographs must be high resolution.
- All photographs must be accompanied by written permission from the copyright holder unless the author owns the rights.
- Wherever possible please try to supply images from the same photographic source or one that are at least compatible with each other. This will ensure that the article is aesthetically pleasing as well as informative.
- We reserve the right to refuse articles

E-mail all submissions to:

information@worldgemfoundation.com

Tino Hammid Memorial Gemmological Scholarship

The World Gem Foundation is delighted to announce the recipients of the Tino Hammid Memorial Gemmological Scholarship for 2020.

Tino Hammid Memorial Gemmological Scholarship

We would like to thank all those who submitted applications for the 2020 Tino Hammid Memorial Gemmological Scholarship. This year we awarded seven scholarships, from a variety of backgrounds and different parts of the world but all sharing an enthusiasm and passion for gemmology.

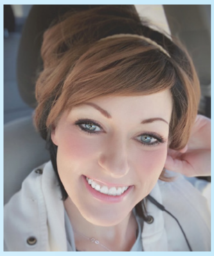
Each successful applicant will now be enrolled in the World Gem Foundation's Career Gemmology (Theoretical) Course and will also be eligible for the W.E.Hunn Memorial Gemmological Scholarship that will provide funding of up to 50% of the cost of their practical studies and final examinations. We wish them all the best of luck.

The 2020 recipients are....

Alexey Tuev
(Russia)

Nelson Tellez Cortez
(Bolivia)

Tendai Masvore
(Zimbabwe)



Lisa Clark
(U.S.A)

Guarino Edilberto Condorilaime
(Bolivia)

Vladimir Gery Alanes Garcia
(Bolivia)

Juan Pablo Vasquez Heredia
(Bolivia)

In 2021, the World Gem Foundation will award five scholarships allowing deserving students to take the World Gem Foundation theoretical 'Career Gemmology' course. The deadline for submitting your application is December 31st, 2020. To download the application form, please click on the image below:

Scholarship Application PDF

Studying Gemmology with the World Gem Foundation

There's an expression 'different strokes for different folks' and this is certainly true in the case of gemmology. We are fortunate to work in an extremely diverse industry; one that provides unlimited opportunities in a broad range of disciplines.

Some people want to become a professional gemmologist; to forge a career for themselves working with gemstones. At the World Gem Foundation, gemmology is not just a job, it's a profession. This is why we opted for the 'Career Gemmologist' designation. We not only want to raise the level of consciousness with consumers but also within our industry. An awareness that gemmology is a science that demands a high level of theoretical knowledge and practical experience.

At the same token, we also understand that not everyone wants to become a fully fledged gemmologist. Many choose to specialise in a particular area, such as diamonds or coloured gemstones. To recognise this, we introduced two new 'Diploma' programs (Diamond Professional and Coloured Gemstone Professional) in 2018.

But what about gemmologists who may have completed their studies five, ten, fifteen or twenty years ago? Since gemmology is constantly evolving, it is important to continually upgrade your knowledge. You simply cannot afford to become complacent. One minute you may be 'up to speed', the next completely 'out of sync'. Each year brings new treatments and enhancements, new lab-created gemstones and new techniques to identify them. It is not the certificate that hangs on your wall that defines who you are as a gemmologist but the knowledge you possess. Our courses can be taken collectively or independent of each other, allowing our students to customise their own personal development programs based on their own specific needs.

Finally, there are many people who share a passion for gemstones but don't necessarily want to enrol in a gemmological program, they simply want to augment their existing knowledge and upgrade their level of understanding.

Regardless of your motivation to expand your knowledge, the World Gem Foundation has a variety of courses and programs that can help you reach your goal.

Career Gemmologist Program

For students wishing to pursue a career in gemmology, our 'Career Gemmologist' program has been especially designed to give you the knowledge and experience required to work as a professional gemmologist. The World Gem Foundation and our affiliated gem academies offer you two options to earn your Career Gemmologist Diploma with our Gemmology Seven/Eleven programs.

Gemmology Seven

This option allows you to complete the entire theoretical requirements by enrolling in our Career Gemmology course (5 modules - 78 lessons) and completing the five practical workshops (Gem Identification #1, Gem Identification #2, Diamond Grading and Lab-created Diamonds, Coloured Gemstone Grading #1 and Lab-created and Treated Gems) and our 60 hour online Coloured Gemstone Grading course.

The theoretical component covers the chemical nature of gemstones, their physical and optical properties, basic crystallography, the absorption of light, the spectroscope, refraction and reflection, the refractometer, optical character and sign, dispersion, reflectivity meters, polarized light, the polariscope, pleochroism, the dichroscope, colour filters, specific gravity, luminescence, magnification and thermal conductivity.

From there we move into the most challenging and fluid areas of gemmology; imitation and composite gemstones, lab-created gemstones and the treatment and enhancement of gems.

In the lessons pertaining to lab-created gemstones you will not only learn about the various methods used to manufacture lab-created gemstones (including Verneuil Flame-Fusion, Czochralski Pulling Method, Flux Melt Method, the Hydrothermal Method, HPHT, CVD, Detonation, Ultrasonic Cavitation Skull Crucible, Zone Melt, Horizontally Oriented Crystallization, the Sublimation Method, and the Modified Stöber Method) but also the unique identifying features that allow us to separate them from their natural counterparts.

The use of treatments and enhancements is both demanding and depending on who you talk to, highly controversial. Here we look at not only the techniques used to treat and enhance gemstones (heat treatment, surface and sub-surface diffusion, lead glass fracture filling, flux assisted partial fissure healing, glass fracture filling, cobalt doped glass filled sapphires, clarity enhanced diamonds, HPHT, quench-crackling, surface modifications, coatings and foil backs, laser drilling and irradiation) but also how they can be detected. We also look at the advanced gem testing techniques that are often needed to identify many of these treatments.

The course then takes a slightly different direction, focusing on the identification of gemstones including the tests that are commonly used to identify them and an in-depth look at each of the ten gemstone groupings based on colour and transparency (colourless or white, red, pink, orange, yellow, blue, green, violet or purple, brown, black or grey). These lessons include the important varieties and species of gemstones that commonly occur within each colour grouping, how to distinguish gemstones that are commonly confused with each other (i.e. aquamarine and blue topaz, emerald and chrome green tourmaline, diamond and lab-created moissanite) or gemstones that have physical and optical properties that are similar (i.e. amethyst quartz and purple scapolite) to each other. This section also includes gemstones that either exhibit optical phenomena (i.e. asterism or chatoyancy) or are unusual by nature.

The next module looks specifically at diamonds, their physical and optical properties, geology, localities, principle mines, crystal system, chemical composition and classification, causes of colour (fancy coloured diamonds), absorption spectra, inclusions, fluorescence, diamond cutting and mining and a comprehensive examination of the 4 C's (colour, clarity, cut and carat weight) and how they are measured and assessed. The lesson on 'Cut' compares some of the most important and recognized 'Cut' grading systems used today including those pioneered by the Gemological Institute of America (GIA), the American Gem Society (AGS), Hoge Raad voor Diamant (HRD), the International Gemological Institute (IGI), the European Gemological Laboratory (EGL) and the Accredited Gem Appraisers (AGA).

The final twenty-nine lessons (29) are devoted to coloured gemstones and covers their physical properties, geology, localities, crystal system, chemical composition and causes of colour, varieties, absorption spectra, pleochroism, inclusions, fluorescence, pricing and care guidelines. Gemstones covered include corundum, beryl, chrysoberyl, spinel, zircon, topaz, tourmaline, peridot, quartz, garnet, tanzanite, lapis lazuli, turquoise, spodumene, feldspars, iolite, andalusite, diopside, apatite, and organic gems (pearls, coral, jet, ivory, and amber). You will also learn about the various colour grading systems currently used (GIA, Gemewizard, GemDialogue and the World of Color) including how to accurately describe colour based on hue, tone and saturation, the clarity classification of gemstones, how cut is assessed, opal, jadeite and pearl grading, and how to estimate the weight of 'mounted' stones.

The study of gemmology simply would not be complete without a comprehensive program of practical instruction. This involves five practical workshops (Gem Identification #1 & #2, Diamond Grading and Lab-created Diamonds, Lab-created and Treated Gems and Coloured Gemstone Grading #1) totalling twenty-eight days of in-class instruction and a 60 hour online Coloured Gemstone Grading course where you will work with the Gemewizard Colour Grading system.

Gemmology Eleven

While the information is the same, the theoretical portion of this program is divided into five free-standing courses (Basic Gemmology, Advanced Gemmology, Gem Identification, Diamonds and Coloured Gemstones). This option allows you to take each course separately giving you greater flexibility in terms of time and how you can pay for the courses.

Like the 'Gemmology Seven' program, there are five practical workshops and one 60 hour online course.

Diamond Professional Program

Designed specifically for those engaged in the diamond trade, this program covers the same theoretical information covered in our 'Diamonds' course plus our eight-day Diamond Grading and Lab-created Workshop.

Coloured Gemstone Professional Program

If your area of expertise is coloured gemstones, this program is ideally suited for you. The CGP program involves the completion of four theoretical courses (Basic Gemmology, Advanced Gemmology, Gem Identification and Coloured Gemstones) plus our two five-day practical Gem Identification workshops, our five-day Coloured Gemstone Grading #1 workshop, our five-day Lab-created and Treated Gems workshop plus our 60 hour online Coloured Gemstone Grading #2 course.

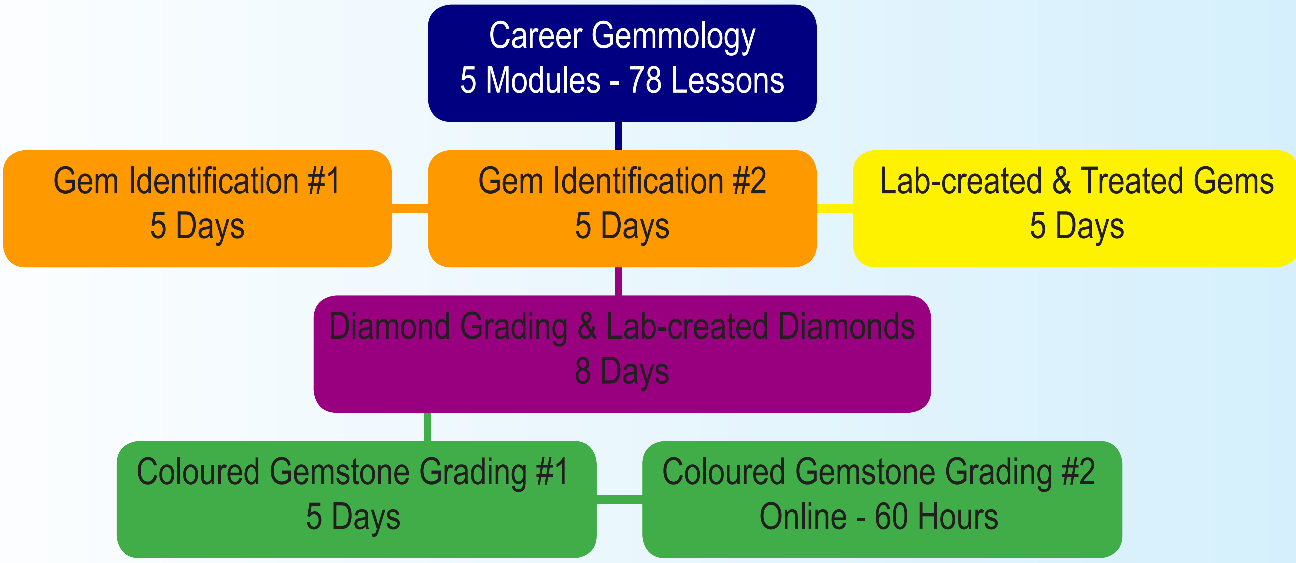
Courses in Other Languages

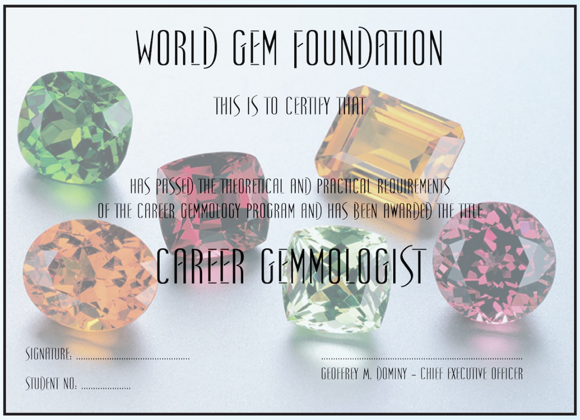
We are currently translating all of our 'Diploma' program courses into Spanish and French to meet the needs of our Spanish and French speaking students. At this time Gemología Básica, Gemología Avanzada and Identificación de Gemas are available in Spanish while Gemmologie Fondamentale, Gemmologie Avanceé, and Pierres de Couleur are available in French.

General Interest Courses

For those interested in gemstones but not wishing to take our 'Diploma' programs, all of our theory courses can be taken independently without prerequisites. In addition to the five theoretical courses (Basic Gemmology, Advanced Gemmology, Gem Identification, Diamonds and Coloured Gemstones) that make up our Career Gemmologist, Diamond Professional and Coloured Gemstone Professional 'Diploma' programs, we also offer three 'General Interest' courses (Rubies, Sapphires and Emeralds, Opals and Jade and Organic Gems).

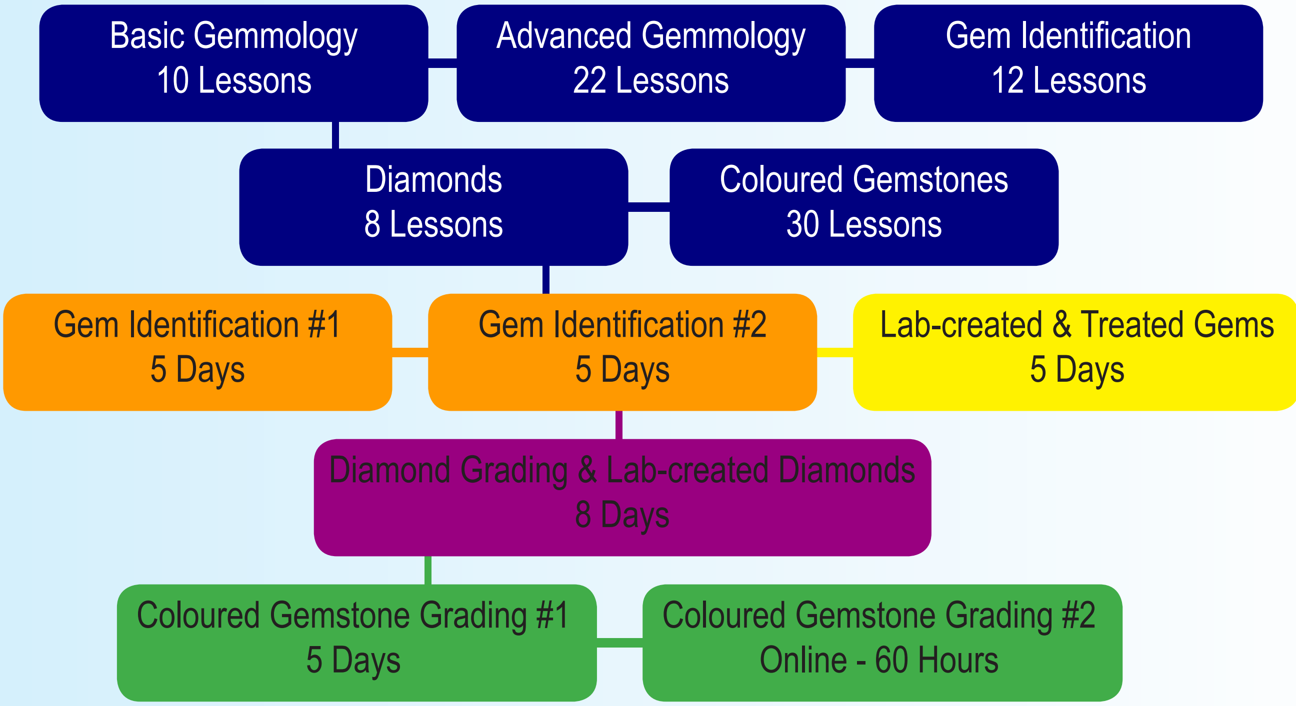
GEMMOLOGY SEVEN PROGRAM





Career Gemmology Seven	Digital Fees			Printed Fees		
Course Name	**Euros**	**Pounds Sterling**	**USD**	**Euros**	**Pounds Sterling**	**USD**
Career Gemmology (Theory)	1400	1100	1600	1570	1235	1795
Gem Identification #1	500	400	550	500	400	550
Gem Identification #2	500	400	550	500	400	550
Coloured Gemstone Grading #1	500	400	550	500	400	550
Coloured Gemstone Grading #2	1000	800	1150	1000	800	1150
Diamond Grading/Lab-created Diamonds	1750	1400	2000	1750	1400	2000
Lab-created & Treated Gems	500	400	550	500	400	550
Examinations Fees (Final Exam)	250	200	280	250	200	280
Total Cost	6400	5100	7230	6570	5235	7425

GEMMOLOGY ELEVEN PROGRAM

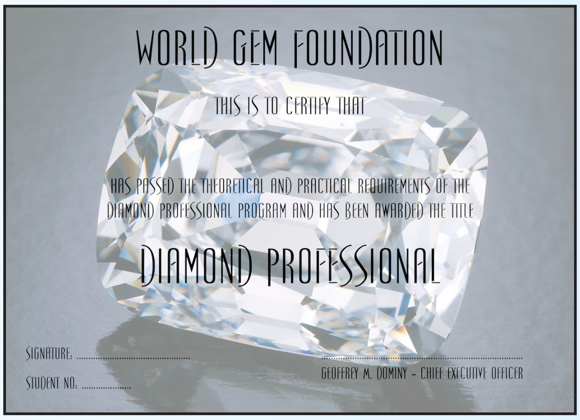


Career Gemmology Eleven	Digital Fees			Printed Fees		
Course Name	**Euros**	**Pounds Sterling**	**USD**	**Euros**	**Pounds Sterling**	**USD**
Basic Gemmology (Theory)	200	150	225	235	180	265
Advanced Gemmology (Theory)	400	300	450	430	325	485
Gem Identification (Theory)	225	175	250	255	200	285
Diamonds (Theory)	225	175	250	255	200	285
Coloured Gemstones (Theory)	500	400	550	565	450	625
Gem Identification #1	500	400	550	500	400	550
Gem Identification #2	500	400	550	500	400	550
Coloured Gemstone Grading #1	500	400	550	500	400	550
Coloured Gemstone Grading #2	1000	800	1150	1000	800	1150
Diamond Grading/Lab-created Diamonds	1750	1400	2000	1750	1400	2000
Lab-created & Treated Gems	500	400	550	500	400	550
Examinations Fees (Final Exam)	250	200	280	250	200	280
Total Cost	6550	5200	7355	6740	5355	7575

DIAMOND PROFESSIONAL

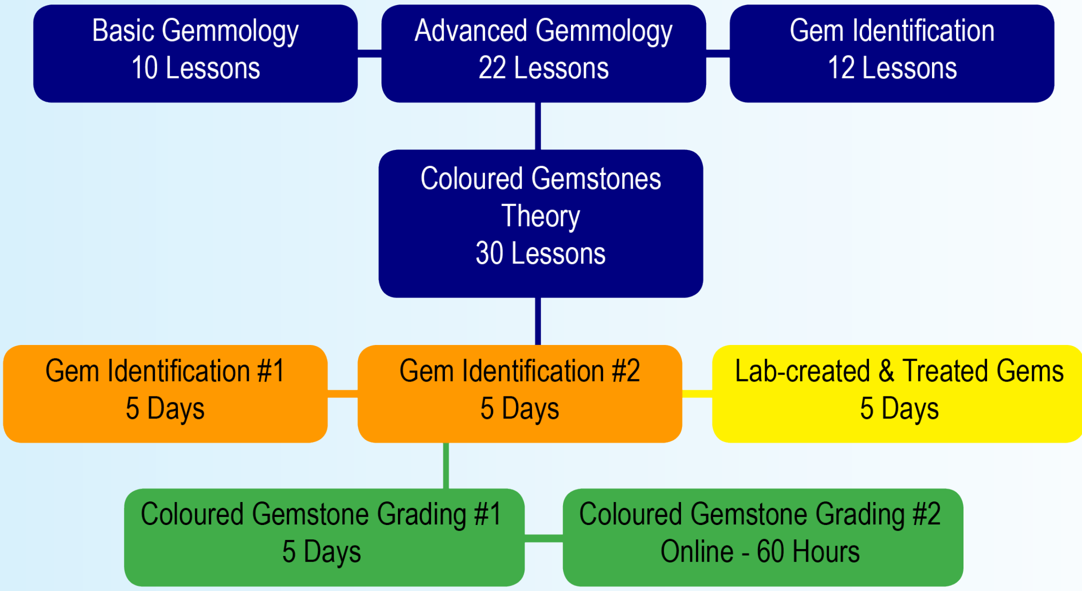
Diamonds
Theory
8 Lessons

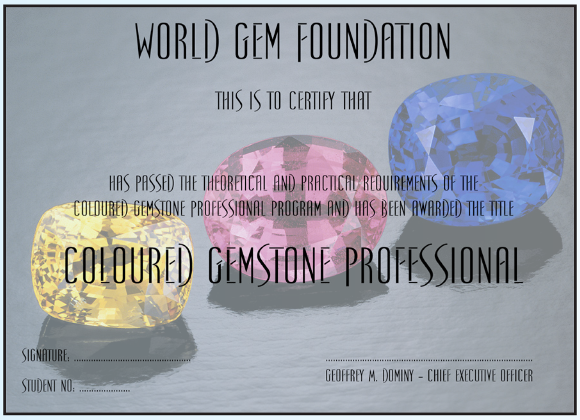
Diamond Grading & Lab-created Diamonds
Practical Workshop
8 Days



Diamond Professional	Digital Fees			Printed Fees		
Course Name	**Euros**	**Pounds Sterling**	**USD**	**Euros**	**Pounds Sterling**	**USD**
Diamonds (Theory)	225	175	250	255	200	285
Diamond Grading/Lab-created Diamonds	1750	1400	2000	1750	1400	2000
Examinations Fees (Final Exam)	250	200	280	250	200	280
Total Cost	2225	1775	2530	2255	1800	2565

COLOURED GEMSTONE PROFESSIONAL





Coloured Gemstone Professional	Digital Fees			Printed Fees		
Course Name	Euros	Pounds Sterling	USD	Euros	Pounds Sterling	USD
Basic Gemmology (Theory)	200	150	225	235	180	265
Advanced Gemmology (Theory)	400	300	450	430	325	485
Gem Identification (Theory)	225	175	250	255	200	285
Coloured Gemstones (Theory)	500	400	550	565	450	625
Gem Identification #1	500	400	550	500	400	550
Gem Identification #2	500	400	550	500	400	550
Coloured Gemstone Grading #1	500	400	550	500	400	550
Coloured Gemstone Grading #2	1000	800	1150	1000	800	1150
Lab-created & Treated Gems	500	400	550	500	400	550
Examinations Fees (Final Exam)	250	200	280	250	200	280
Total Cost	4575	3625	5105	4735	3755	5290

Rubies, Sapphires & Emeralds

This course focuses on three coloured gemstones (rubies, sapphires and emeralds) that individually and collectively are considered the cornerstones of the coloured gemstone trade. Lessons include a complete overview of their physical and optical properties, principal sources, mining, how they can be identified from gemstones that can be deceptively similar in appearance and their lab-created counterparts, common treatments and enhancements, pricing guidelines, what constitutes the best quality and how to properly care for them.

Opals and Jade

This course looks at two of the most fascinating and complex gemstones in the world of gemmology. The lessons on opal cover their physical and optical properties, their geology, localities, crystal system, chemical composition and classification, varieties, cause of colour, absorption spectra and pleochroism, inclusions, fluorescence, principal mines, opal mining in Australia, opal grading, synthesis of opal, gem identification, common treatments and enhancements, opal doublets and triplets, cleaning and care and pricing.

The section on jade follows a similar format with lessons covering their physical and optical properties, their geology, localities, crystal system, chemical composition, absorption spectra and pleochroism, inclusions, fluorescence, mining, principal mines, evaluating the rough, jadeite cutting, jadeite nomenclature, grading jadeite, synthesis of jadeite, gem identification, common treatments and enhancements, cleaning and care and pricing.

Organic Gems

This course explores a very select group of gemstones (coral, jet, amber, ivory and pearls), formed through organic processes rather than through geological forces deep within the earth's surface. Lessons cover their physical and optical properties, geological formation, crystal systems, chemical composition, varieties and classification, causes of colour, common inclusions and internal characteristics, fluorescence, pearl grading criteria, methods of synthesis, gem identification, common treatments and enhancements, and cleaning and care instructions.

Online Tutoring

While clearly the ideal way to learn a particular subject is in a classroom or with one-on-one tutoring, we appreciate that this is difficult when you enrol in a long distance study program.

Fortunately, new distance learning technologies are changing. Now teachers can connect with their students virtually using a variety of virtual tutoring tools, such as Skype.

The chart below outlines the number of online tutoring hours that are included in our course prices. If you require more online instructional tutoring, please contact your education coordinator to discuss availability and pricing.

Course Name	Hours
Basic Gemmology - Theory	2
Advanced Gemmology - Theory	4
Gem Identification - Theory	2
Diamonds - Theory	2
Coloured Gemstones - Theory	5
Career Gemmology - Theory	14

We strongly suggest that you contact your instructor beforehand by e-mail with your questions so that you will derive maximum benefit from your online sessions. Please remember that these sessions are designed to provide you with 'coaching' rather than direct instruction.

Once a Student, Always a Student

With our 'Once a student, always a student' policy, every registered World Gem Foundation student receives lifetime access to their student page. So every time we update our courses, they get the latest version free of charge.

Why? Because at the World Gem Foundation, we believe you should never stop learning.

Course Fees

Fees charged by the individual gem academies are charged in the prevailing currency for that particular area (i.e. Euros in Europe, Pounds Sterling in Britain). Please note that shipping charges apply to any courses provided in print.

2020 Workshops

Interested in taking one of our practical workshops in Europe in 2020? Click here to see the current schedule.

Practical Workshops

Course Cost € 500

Reserve Your Place Now

Gem Identification #1

This five day (30 hour) practical workshop focuses on the study and identification of six colour groupings (colourless/white, red, pink, orange, yellow and green) and basic crystallography. Gemstones covered in this workshop include:

Natural Diamond, Natural Ruby, Natural Sapphire, Emerald, Beryl, Garnets (Spessartite, Almandite Rhodolite, Pyrope, Colour Change, Hessonite, Demantoid, Tsavorite and Grossular), Spinel, Tourmaline, Topaz, Beryl, Quartz, Zircon, Alexandrite, Chrysoberyl, Apatite, Kunzite, Sunstone, Sphalerite, Sphene, Phenakite, Brazilianite, Scapolite, Hiddenite, Danburite, Benitoite, Diaspore, Epidote, Kyanite, Idocrase, Sinhalite, Diopside, Kornerupine, Enstatite, Euclase, Andalusite, Ekanite, Idocrase, Moldavite, Obsidian, Chrome Chalcedony, Amazonite, Jadeite, Nephrite, Chalcedony, Dyed Jasper, Chrysoprase, Maw-Sit Sit, Rhodonite, Rhodochrosite, Amber, Coral, Fire Opal, Lab-created Moissanite, Cubic Zirconia, GGG, YAG, Lab-created Rutile, Strontium Titanate, Lithium Niobate, Lab-created Spinel, Glass, Lab-created Alexandrite, Garnet-topped Doublet, Spinel Triplet, Copal Resin, Bakelite and Imitation Coral.

Prerequisites: Basic Gemmology or Equivalent

Course Cost € 500

Reserve Your Place Now

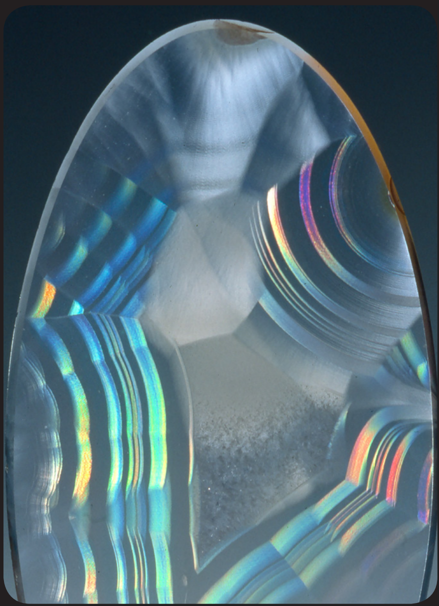
Gem Identification #2

This five day (30 hour) practical workshop focuses on the study and identification of four colour groupings (blue, violet/purple, brown and black) plus unusual and phenomenal gemstones. Gemstones covered in this workshop include:

Sapphire, Benitoite, Spinel, Tanzanite, Apatite, Tourmaline, Topaz, Aquamarine, Quartz, Iolite, Zircon, Scapolite, Garnet (Grape, Rhodolite and Hessonite), Chrysoberyl, Taafeite, Idocrase, Ekanite, Sinhalite, Kornerupine, Andalusite, Kyanite, Euclase, Smithsonite, Sugilite, Charoite, Lapis Lazuli, Sodalite, Turquoise, Odontolite, Serpentine, Chrysocolla, Petrified Wood, Hematite, Marcasite, Pyrite, Jadeite, Jet, Chalcedony, Jasper, Coral, Obsidian, Cubic Zirconia, Bakelite, Dyed Jasper, Lab-created Forsterite, Lab-created Spinel, Lab-created Quartz, Glass, Gilson Lapis Lazuli, Gilson Turquoise, Stained Howlite, Star Sapphire, Star Ruby, Star Almandite Garnet, Star Diopside, Cat's Eye Chrysoberyl, Cat's Eye Tourmaline, Cat's-Eye Quartz, Hawk's Eye Quartz, Tiger's-Eye Quartz, Bi-Colour Tanzanite, Bi-Colour Tourmaline, Ametrine Quartz, Watermelon Tourmaline, Usambara Tourmaline, Trapiche Emerald, Labradorite, Moonstone, Bloodstone, Tortoiseshell, Shell Cameo, Hardstone Cameo, Lava Cameo, Ammolite, Fire Agate, Black Opal, Crystal Opal, Semi-Crystal Opal, Larimar, Malachite, Lab-created Cat's Eye Chrysoberyl and Imitation Cameo.

Prerequisites: Gem Identification #1 or Equivalent

Practical Workshops



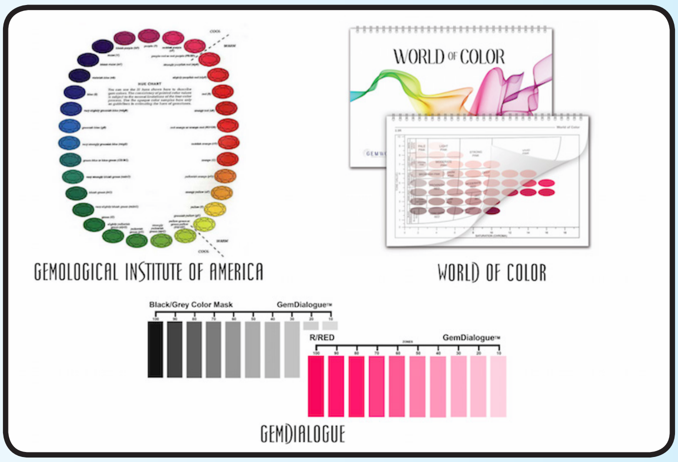
Course Cost € 500

Reserve Your Place Now

Coloured Gemstone Grading #1

This five-day (30 hours) workshop includes practical instruction on how to access the hue, tone and saturation of coloured gemstones using three popular colour grading systems (Gemological Institute of America, GemDialogue and World of Color) and how to grade pearls, jadeite and opals.

Prerequisites: None



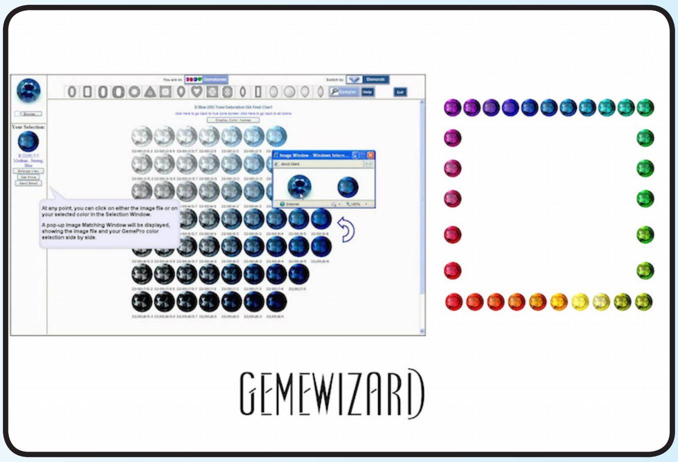
Course Cost € 1000

Reserve Your Place Now

Coloured Gemstone Grading #2

This 60 hour online course consists of a comprehensive overview of the GemeWizard Colour Grading System including colour theory (hue, tone and saturation), how they impact on the value of gemstones, practical exercises that are completed online, and a six month subscription to the Gemewizard program.

Prerequisites: None



Practical Workshops

Course Cost € 500

Reserve Your Place Now

Lab-created & Treated Gems

This five day (30 hour) practical workshop focuses on lab-created gemstones (specifically rubies, sapphires and emeralds) and the many treatments and enhancements that are used to improve the appearance and/or value of gemstones, including:

- Heat treatment
- Surface and Sub-surface Diffusion
- Irradiation
- Fracture Filling
- HPHT Treatment
- Oiling
- Waxes & Dyes
- Sugar/Acid & Smoke Inhalation
- Quench-crackling with Dyes
- Coating & Foil Backs
- Laser Drilling

Prerequisites: Advanced Gemmology or Equivalent

Course Cost € 1750

Reserve Your Place Now

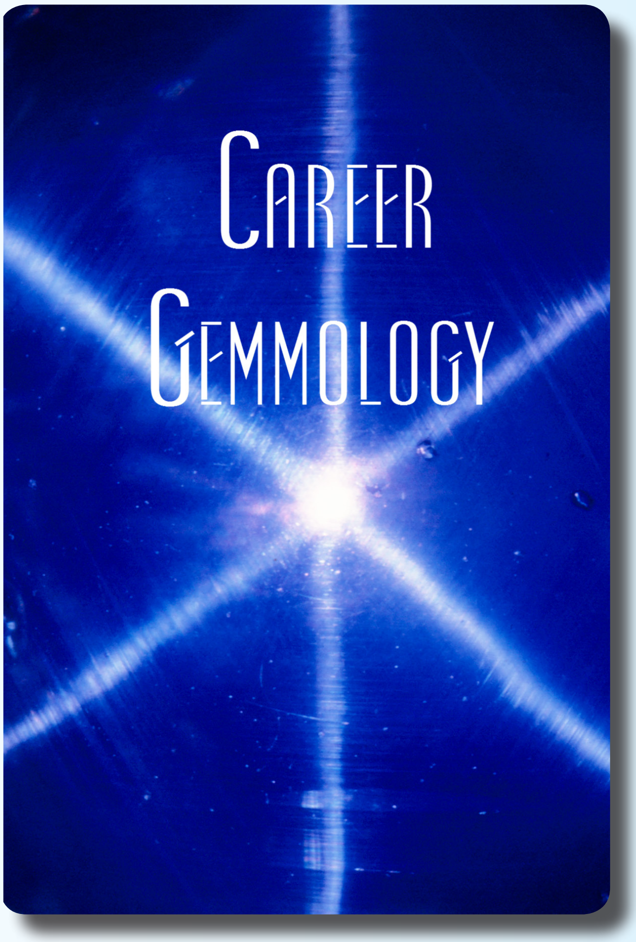
Diamond Grading & Lab-created Diamonds

This eight day (48 hour) practical workshop focuses on the clarity and colour grading of diamonds, how to measure the proportions and how to distinguish natural from HPHT and CVD diamonds.

Topics covered include:

- Clarity Grading
- Colour Grading
- Calculating Table Percentage
- Calculating Crown Angle
- Calculating Pavilion Percentage
- Estimating Girdle Thickness
- Assessing Symmetry & Polish
- Lab-Created Diamonds
- Practical Review

Prerequisites: Diamonds or Equivalent



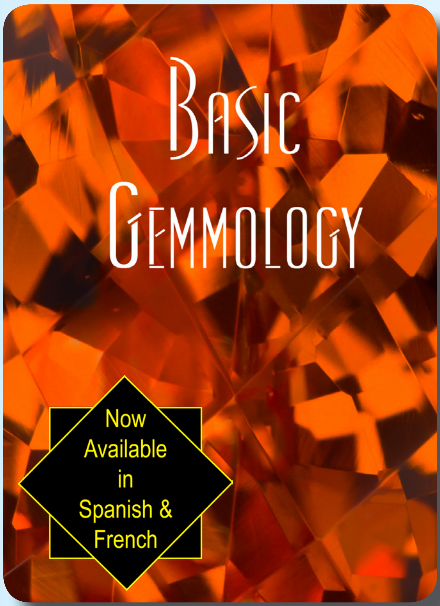
Course Content

The chemical nature of gemstones, their physical and optical properties, basic crystallography, the absorption of light, the spectroscope, refraction, reflection and the refractometer, polarized light, the polariscope, pleochroism, the dichroscope, colour filters, specific gravity, luminescence, magnification, thermal conductivity, imitation, assembled and lab-created gemstones, the methods used to manufacture lab-created gemstones including Verneuil, Czochralski, flux melt, hydrothermal, skull crucible, zone melt, horizontally oriented crystallization, high pressure, high temperature (HPHT), chemical vapour deposition (CVD), detonation, ultrasonic cavitation, sublimation method, and modified Stöber method, their unique identifying features, treatments and enhancements including heat treatment, surface and sub-surface diffusion, lead glass fracture filling, flux assisted partial fissure healing, glass fracture filling, cobalt doped glass filled sapphires, clarity enhanced diamonds, high pressure, high temperature (HPHT), quench-crackling, surface modifications, coatings and foil backs, laser drilling, and irradiation, gem mining and cutting, diamond and coloured gemstone grading, gem identification by colour and transparency, advanced gem testing techniques and a comprehensive overview of the twenty-seven most common groups, species and varieties including diamonds, corundum (rubies and sapphires), beryl (emeralds, aquamarines and other precious beryls), chrysoberyl (alexandrite and other chrysoberyl), spinel, zircon, topaz, tourmaline, peridot, quartz, garnet, tanzanite, lapis lazuli, turquoise, opal, jadeite, kunzite and hiddenite, feldspars, iolite, andalusite, diopside, apatite, pearls, coral, jet, ivory and amber.

Course Cost: € 1400

Prerequisites: None

Please Note: This course includes all the information contained in the Basic Gemmology, Advanced Gemmology, Gem Identification, Diamonds and Coloured Gemstones courses.

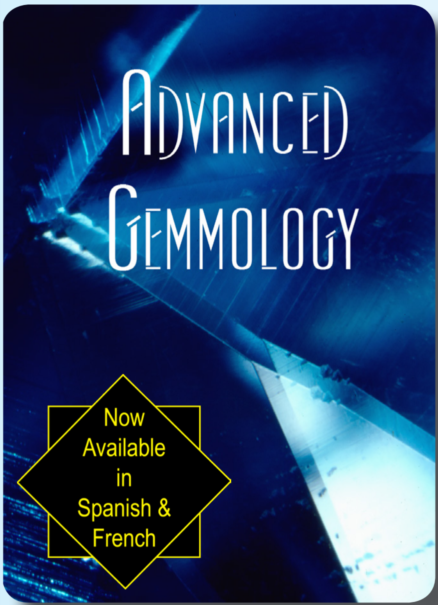


Course Content

The chemical nature of gemstones, physical and optical properties, basic crystallography, the absorption of light, the spectroscope, refraction and reflection, the refractometer, optical character and sign, dispersion, reflectivity meters, polarized light, the polariscope, pleochroism, the dichroscope, colour filters, specific gravity, luminescence, magnification and thermal conductivity.

Course Cost: € 200

Prerequisites: None

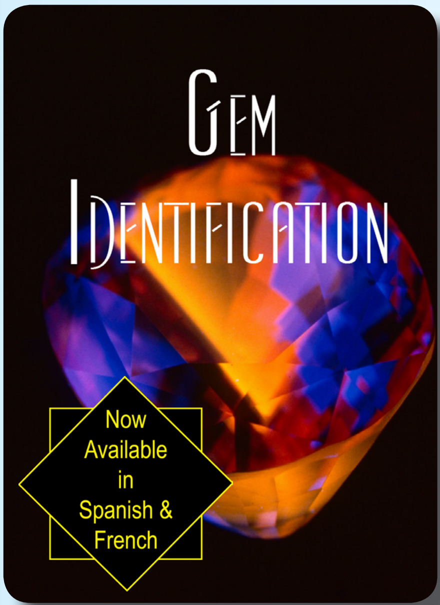


Course Content

Imitation and composite gemstones, methods used to manufacture lab-created gemstones including Verneuil, Czochralski, Flux Melt, Hydrothermal, Skull Crucible, Zone Melt, Horizontally Oriented Crystallization, HPHT, CVD, Detonation, Ultrasonic Cavitation, Sublimation Method, and Modified Stober Method, their unique identifying features, treatments and enhancements including heat treatment, surface and sub-surface diffusion, lead glass fracture filling, flux assisted partial fissure healing, glass fracture filling, cobalt doped glass filled sapphires, clarity enhanced diamonds, HPHT, quench-crackling, surface modifications, coatings and foil backs, laser drilling, irradiation, and advanced gem testing techniques.

Course Cost: € 400

Prerequisites: Basic Gemmology or Equivalent

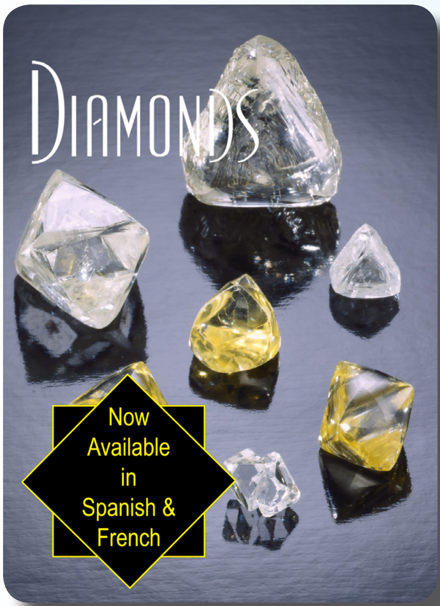


Course Content

Introduction to gem identification and the tests that are commonly used to identify gemstones. An in-depth look at each of the ten colour groupings (colourless or white, red, pink, orange, yellow, blue, green, violet or purple, brown, black or grey) plus phenomenal or unusual gemstones. Important varieties and species of gemstones that commonly occur within each colour grouping. How to distinguish gemstones that are commonly confused with each other (i.e. aquamarine and blue topaz, emerald and chrome tourmaline, diamond and lab-created moissanite) or have physical and optical properties that are similar (i.e. amethyst quartz and purple scapolite). All lab-created, imitation, treated and enhanced gemstones that are found in each colour grouping.

Course Cost: € 225

Prerequisites: Basic & Advanced Gemmology or Equivalent

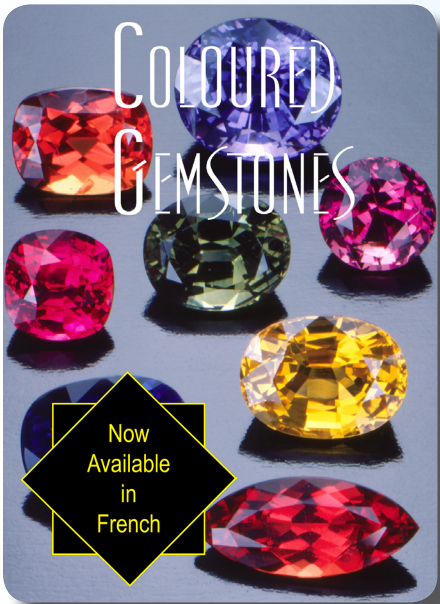


Course Content

Physical properties, geology, localities, principle mines, crystal system, chemical composition and classification, fancy colours, causes of colour, absorption spectra, pleochroism, inclusions, fluorescence, mining, gem identification, methods of synthesis, common treatments and enhancements. You will learn all about the 4 C's (colour, clarity, cut and carat weight) and how they are measured and assessed. We will also compare the various 'Cut' criteria for the Gemological Institute of America (GIA), the American Gem Society (AGS), Hoge Raad Diamant (HRD), International Gemological Institute (IGI), the European Gemological Laboratory (EGL), and Accredited Gem Appraisers (AGA) and explain how the estimated weight of a 'mounted' gemstone is calculated.

Course Cost: € 225

Prerequisites: None

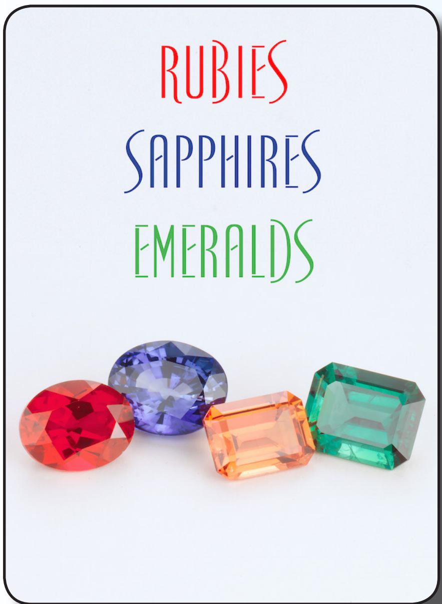


Course Content

Physical properties, geology, localities, crystal system, chemical composition and causes of colour, varieties, absorption spectra, pleochroism, inclusions, fluorescence, gem identification, synthesis, treatments and enhancements, and care guidelines. Gemstones covered in this course include rubies and sapphires, emeralds, aquamarines and other precious beryls, alexandrite and other chrysoberyls, spinel, zircon, topaz, tourmaline, peridot, quartz, garnet, tanzanite, lapis lazuli, turquoise, kunzite, hiddenite, feldspars, iolite, andalusite, diopside, apatite, pearls, coral, jet, ivory, and amber. You will learn how to accurately describe colour, the various colour grading systems currently used by professionals, the clarity classification of gemstones based on their geological environments, how cut is assessed, and how to grade opals, jadeite and pearls.

Course Cost: € 500

Prerequisites: None



Course Content

Topics covered include a complete overview of their physical and optical properties, principal sources, mining, how they can be identified from gemstones that can be deceptively similar in appearance and their lab-created counterparts, common treatments and enhancements, pricing guidelines, what constitutes the best quality and how to properly care for them.

Course Cost: € 95

Prerequisites: None

Course Content

Topics covered in the course include their physical and optical properties, geological formation, crystal systems, chemical composition, varieties and classification, cause of colour, absorption spectra, common inclusions, fluorescence, mining, grading criteria, methods of synthesis, gem identification, common treatments and enhancements, cleaning and care instructions, and pricing.

Course Cost: € 75

Prerequisites: None

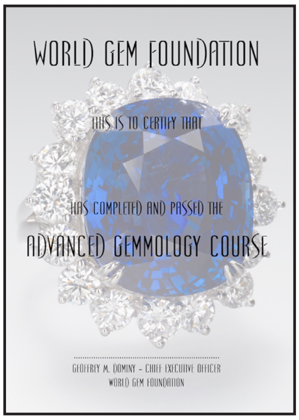
Course Content

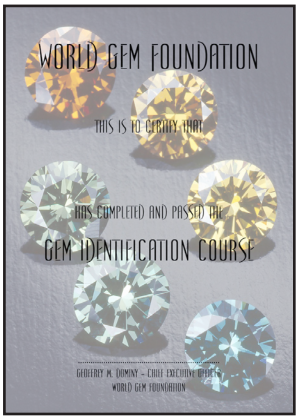
Topics covered include their physical and optical properties, geological formation, crystal systems, chemical composition, varieties and classification, cause of colour, common inclusions and internal characteristics, fluorescence, pearl grading criteria, methods of synthesis, gem identification, common treatments and enhancements, and cleaning and care instructions.

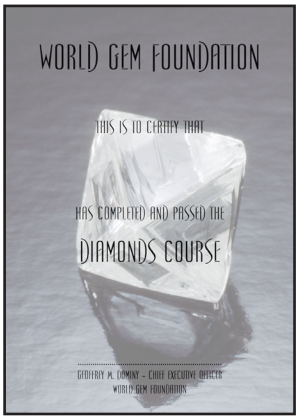
Course Cost: € 50

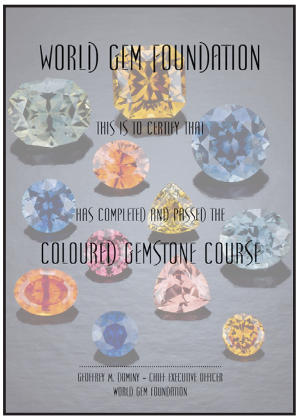
Prerequisites: None

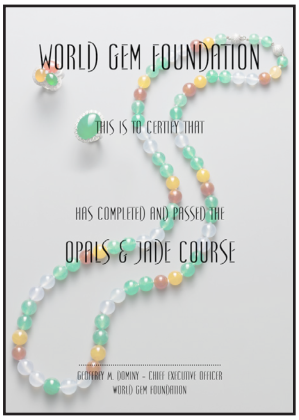
Theory Courses - Letters of Completion

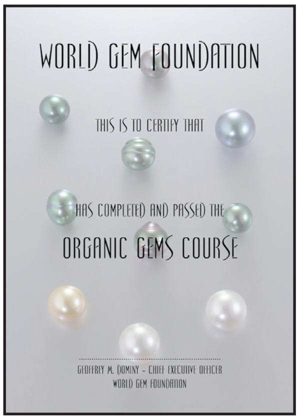




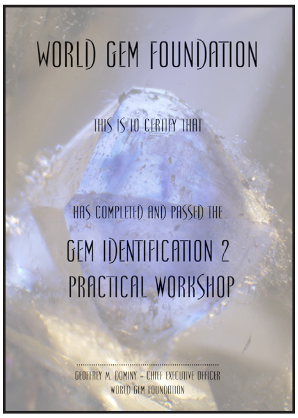


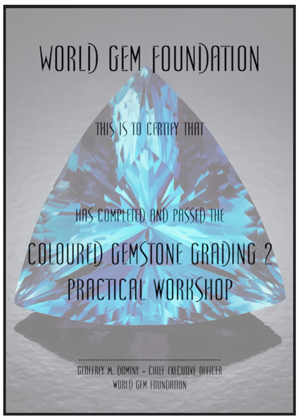


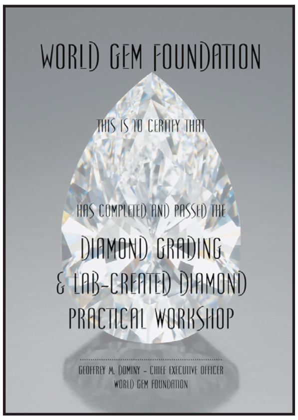




Practical Workshop - Letters of Completion







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Madrid - 2020 Schedule

Course Name	Dates			
Gem Identification #1	March 2 - 6	May 4 - 8	Aug 31 - Sept 4	Oct 19 - 23
Gem Identification #2	March 9 - 13	May 11 - 15	Sept 7 - 11	Oct 26 - 30
Coloured Gemstone Grading #1	March 16 - 20	May 18 - 22	Sept 14 - 18	Nov 3 - 7
Lab-created & Treated Gems	March 23 - 27	May 25 - 29	Sept 21 - 25	Nov 9 - 13
Diamond Grading & Lab-created Diamonds	April 1 - 8	June 3 - 10	Sept 30 - Oct 7	Nov 18 - 25

Amsterdam - 2020 Schedule

Course Name	Dates			
Gem Identification #1	March 16 - 20	May 25 - 29	Sept 14 - 18	Nov 3 - 7
Gem Identification #2	March 23 - 27	June 1 - 5	Sept 21 - 25	Nov 9 - 13
Coloured Gemstone Grading #1	April 1 - 5	June 8 - 12	Sept 28 - Oct 2	Nov 18 - 25
Lab-created & Treated Gems	June 15 - 19	Oct 5 - 9		
Diamond Grading & Lab-created Diamonds	June 24 - July 1	Oct 14 - 21		

Please note that classes are limited to six participants. To reserve your place, please download the applicable course application forms.

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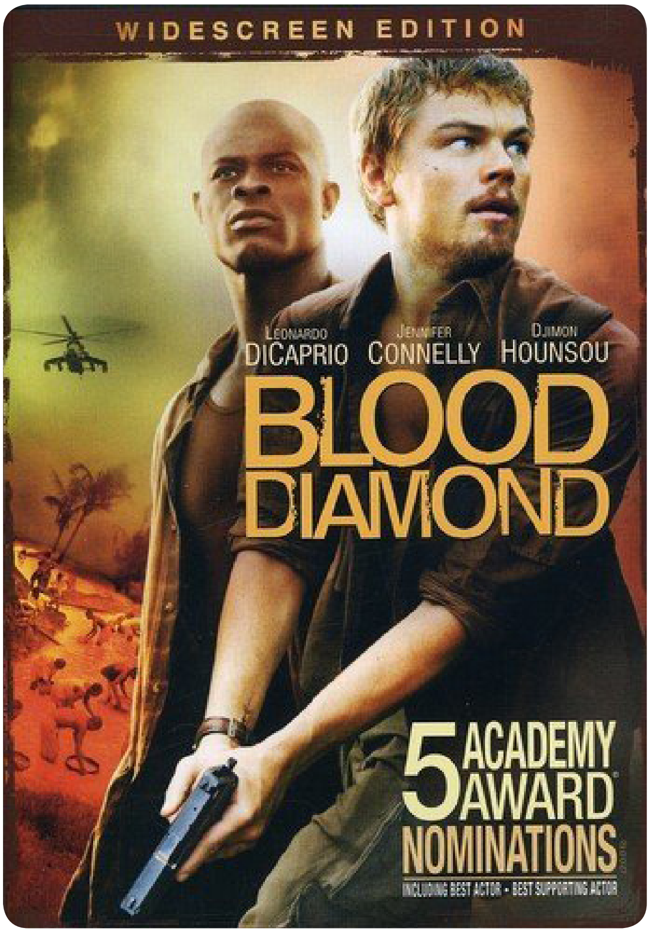
Small Scale Mining in Kenema Region Sierra Leone (Photo by Torbjórn Lindwall)

Small Scale Mining in Kenema Region Sierra Leone (Photo by Torbjórn Lindwall)

JAN ASPLUND is the joint CEO of the Scandinavian Gem Academy. He received his FGA (Diploma in Gemmology) and DGA (Gem Diamond Diploma) through Gem-A in 2011, his BA in History from the Mälardalens University in 2000 and studied geology and gemmology at Luleå Technical University (2005 – 2007).

Blood, Sweat & Fears



Distributed by Warner Bros

Diamonds were first found in West Africa in 1910 along various rivers in Liberia. Diamond deposits have also been found in Ghana, Sierra Leone, Guinea and the Ivory Coast with smaller to insignificant finds in Senegal, Mali and Togo. Kimberlite core samples in Mauritania containing diamonds have also been found although no commercial exploration has taken place. Reports of diamonds, in Burkina Faso however have proven to be false (Cunningham 2011 p 62, 73).

Of all the West African diamond producing countries it is probably Sierra Leone that is best known although perhaps for all the wrong reasons. The moment the words 'diamond' and 'Sierra Leone' are mentioned in the same sentence, most people immediately associate it with the Steven Spielberg movie 'Blood Diamond' featuring Leonardo DiCaprio or the song by Kanye West 'Blood diamonds'.

This connection between 'diamonds' and 'blood' stems from the use of diamonds from Sierra Leone to finance the bloody civil war in the country in the 1990s that also played a part in financing the earlier civil war in Lebanon as well as the conflict in Liberia. Diamonds from Sierra Leone also played a minor role in financing the terror group Al Qaeda. While a very small minority of the worldwide production of diamonds are associated with organised crime, war and terror, the fact that diamonds have been used to finance criminal behaviour and humanitarian atrocities has lead to a new awareness by the buyers and sellers of diamonds and the general public, concerned about the origin of their diamonds and their journey through the diamond pipeline to the end consumer.

From time to time, comparisons have been made between Sierra Leone and other West African diamond producers to Botswana implying that if for instance Sierra Leone had had a more stable political history and less corruption, the country could have benefitted as much from diamonds as Botswana. The comparison is far from fair as the nature of the diamond deposits is fundamentally different. The diamonds in Botswana are mined from primary deposits demanding advanced and expensive mining equipment and educated workers while the deposits in West Africa are alluvial and often occur along rivers making it possible for anyone to mine with simple tools such as a washing pan. The deposits in Botswana cover a relatively small geographical area that is easy to control while the alluvial deposits in West Africa cover very large areas, often without any infrastructure (Smillie 2014 p 46).

Primary deposits do exist in West Africa with the first kimberlite pipes first found in the mid 1950s. Today, kimberlite deposits have been identified in Guinea, Sierra Leone, Liberia, and Mali on the so-called West African Craton, although most are not diamond bearing. To date, primary diamond deposits have been found in Sierra Leone, Guinea and Ivory Coast (Taylor et. al. 1994) however due to the high cost of extraction and the relative ease and accessibility of alluvial deposits, very little mining of the primary deposits have been carried out.

In the years following WWII there was a rapid growth of diamond production in most of the West African countries. In 1946/47, Ghana exported 35,956 carats, a production that a few years later (1952/53) would reach 1.3 million carats. Production and exports grew even more in the 1950s but due to changes in government policies in the 1960s production fell drastically and the official production in Ghana was down to only 15,579 carats in 1968/69.

In 1961, Guinea produced 1 million carats while the Ivory Coast produced 300,000 carats however the suppression of diamond digging in the Ivory Coast in 1962 and exchange controls and nationalisation in Guinea drastically decreased production (Greenhalgh 1985 p 148).

The chronology of diamonds in West Africa starts in 1910 when diamonds were found along the Jiblong and Bor rivers in Liberia. All main river systems in the western part of the country contain diamonds but very little organised mining has been carried out apart from in the 1960s when the Liberian Swiss Mining Corporation, Liswimco, tried to organise the exploration. Diamond export numbers from Liberia however do not relate to the country's actual production, especially in the period 1980 to 1990, as large amounts of illegally mined diamonds from Sierra Leone were smuggled to Liberia and exported from there.

In Ghana, diamonds were found in 1919 by Albert Kitson, the director of the Gold Coast Geological Survey on the banks of the Abomo stream in the Akwatia area. At its peak in the 1960's Ghana exported 3 million carats a year, however since this time, the numbers have been in constant decline and in 2018 totalled around 50,000 carats (Cunningham 2011; Kimberley Process 2020).

In Mali alluvial diamonds were found in 1955 and the year after a kimberlite pipe was discovered in Kenieba in western Mali. The area has produced several large diamonds, including a 233 carat stone. So far eight diamondiferous kimberlites have been identified but very little production has taken place in the last decades (Cunningham 2011 p 73; Kimberley Process 2020).

A few gem quality diamonds, the largest weighing 20 carats, were found in Togo from 1990 until present day but once again, no organised production has occured in the country (Cunnningham 2011 p 96).

Diamonds were discovered in Sierra Leone in 1930 and since Sierra Leone is the most well known example of where diamonds have been used to finance war and terror more details will be given here than for the other West African diamond producers.

Similar to many other diamond discoveries the first diamonds were found in river gravels by prospectors looking for gold. This was documented in a letter sent to the colonial secretary in Freetown from the geological department stating that while prospecting for gold in the Gbobora stream at Fortingala, two diamonds weighting between 0.20 – 0.25 carats each had been found (Frost 2012 p 33-34).

In 1935, De Beers negotiated a deal with the government to legally take control of all mining prospects for the next 99 years. However, this did not last, and in 1984 De Beers left, a victim of the nationalisation of the diamond trade and unreliable political leadership eventually selling their last shares in the National Diamond Mining Co. to Jamil Mohammed, a Lebanese businessman and key adviser to the President Siaka Stevens (Johnson 2003).

The issuing of digging licences was the result of failed suppression of illegal mining and from July 1954 an adjustment of Government policy gradually legalized the major parts of what had been an illicit diamond rush in Sierra Leone (Van Der Laan 1965 p 1). The Alluvial Mining Scheme, passed in 1956, has been described as both a success and a failure, creating legitimate jobs for thousands of people on the one hand and drastically increasing illegal mining by over 75,000 people on the other. Before the issuance of digging licences in 1956, digging for diamonds had been forbidden by Africans (Johnson 2003; Greenhalgh 1985 p 152-154).

President Siaka Stevens successor Joseph Momoh lacked political leader skills resulting in Mohammed gaining more and more power and responsibility. During the reigns of Stevens and Momoh, Sierra Leone's official diamond production fell from over two million carats in 1970 to 595,000 carats in 1980 to a mere 48,000 in 1988. The reason for the decreasing numbers was not a result of the country running out of diamonds or that no one was mining them, on the contrary, the production was probably as large as ever, it was more a result of illicit diamond trading and governmental corruption (Johnson 2003).

Rebel groups and guerrillas became increasingly involved in diamond smuggling in the early 1990s as a result of decreased funding from other countries using West Africa as a field for confrontations between the east and west during the cold war (Smillie 2014 p 66-67).

Eventually the situations in Sierra Leone lead to one of the most awful conflicts in modern history with the systematic raping of women and young girls, mutilation and murder. In the nine-year civil war 1991-1999 over 75,000 people were killed. The scars still remain today, with mutilated former farmers, traumatized rape victims and kidnapped sex slaves, including children, a constant reminder of what Sierra Leoneans endured during this time (Johnson 2003).

Other West African countries have also suffered with similar problems as Sierra Leone but not to the same extent. The conflict in Sierra Leone and the obvious connection between illegally mined and exported diamonds and the financing of rebels, terrorists and a corrupted national military was a founding stone for the Kimberley Process.

The diagram below shows the production of rough diamonds in carats for the five major West African diamond producing countries for the years 1950, 1980 and 2018. The value per carat varies considerably between the producers with the highest value per carat from Liberia exporting at 401 USD per carat in 2018 while Ghana the same year saw an average value at 34 USD per carat (Greenhalgh 1985; Johnson 2003; Kimberley Process 2020).

Country/Year	1950	1980	2018
Sierra Leone	493,000	595,000	741,586
Guinea	72,000	-	292,707
Liberia	-	356,000	79,323
Ghana	1,837,000	1.009,000	53,573
Ivory Coast	80,000	40,000	5,677

Overall diamond production in West Africa has declined considerably since the latter years of the 20th century with the exception of Guinea. While there is still potential for a profitable diamond production in several countries, there are still many challenges that need to be overcome before diamonds can be truly beneficial to the people of West Africa. Considering the price many have paid in the name of diamonds and the terrible crimes they have perpetrated, the diamond industry owes the people of West Africa, especially those foreign mining and jewellery companies who profited during this time as receivers of illegal diamonds.

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Rough Diamonds (Photos by Torbjórn Lindwall)

Small Scale Mining in Kenema Region Sierra Leone (Photo by Torbjórn Lindwall)

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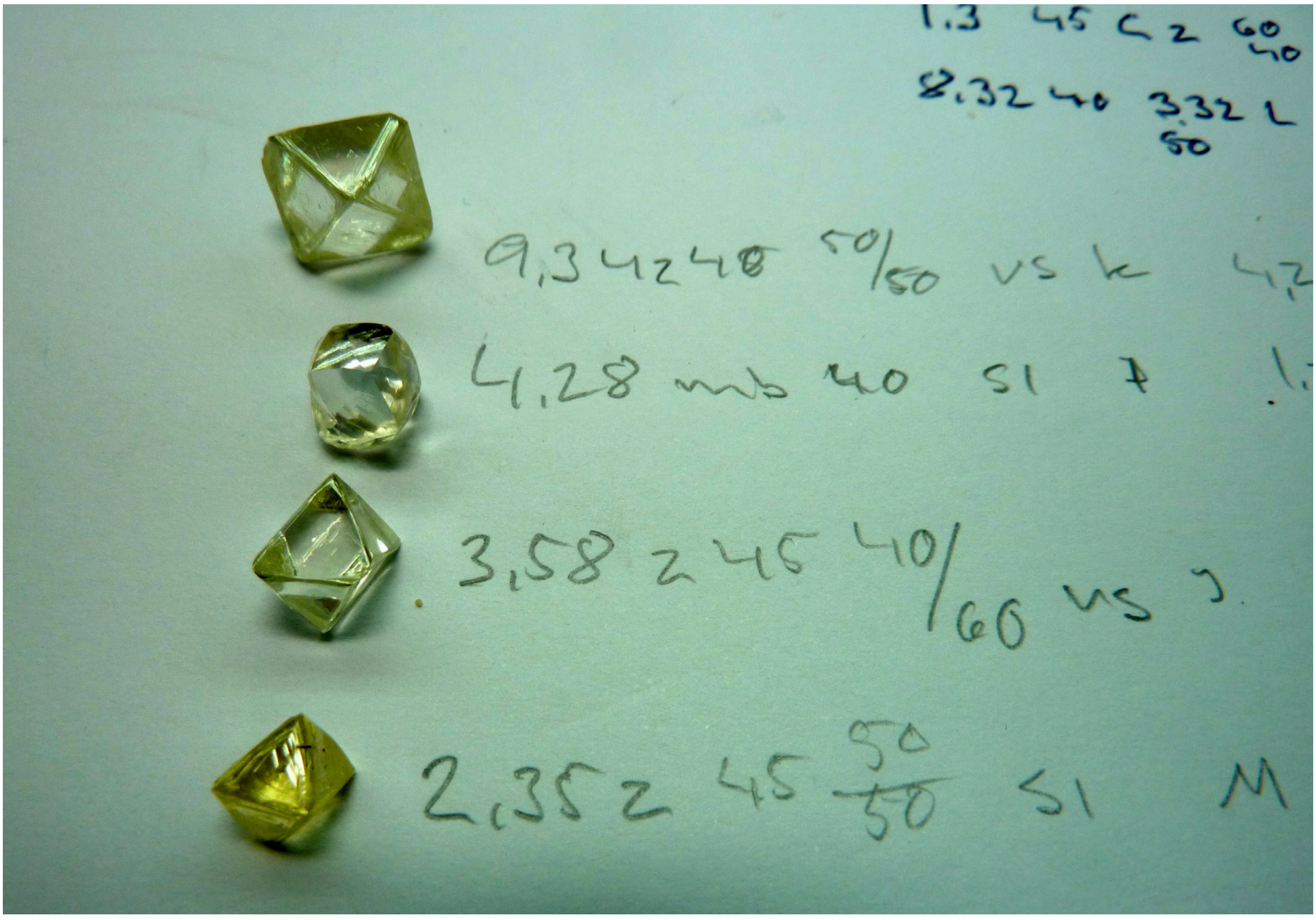


Rough Diamonds Sierra Leone (Photo by Torbjórn Lindwall)

In this issue, NINA ZOLOTUKHINA looks at the various gem testers that have become the mainstay for most jewelers. But is placing your 'blind faith' in an instrument such a good idea? Nina is not so sure...........

Gemology Toys for Girls and Boys

To many people, gem testers are like toys: without really knowing what principle they are based on, they are happy to press a button, wait a few seconds and obtain a result. But how accurate are they and should we really believe them or not?

In this article I want to share with you my experience testing various types of low cost gem testers (under $ 600 USD) that are commonly used by jewellers and gemmologists. Looking at their strengths and weaknesses and understanding the principles they are based upon.

Thermal Conductivity Gem Testers (from $ 10 USD)

Let's start with thermal conductivity gem testers, which are by far the most popular.

As the name suggests, they work on the principle of thermal conductivity. When the heated probe comes into contact with a gemstone, the device measures the rate at which heat moves through the stone. These devices were created specifically to differentiate diamonds from their many simulants since diamonds conduct heat significantly more than other gemstones. I bought my 'Diamond Selector II' on Ebay for $ 10 USD!

When using this tester, you need to allow it to warm up first, place the stone on a special testing plate and ensure that you do not touch it with your fingers since this could give incorrect results.

While this type of tester is good for distinguishing diamonds from other gemstones with lower thermal conductivity, it cannot be used for separating diamonds from lab-created moissanite, because the latter also have high thermal conductivity and would give an erroneous result for a diamond. Today, lab-created moissanite is quite prevalent so it is very important that users of thermal conductivity testers appreciate the fact that while they will detect 'diamonds', those diamonds could in fact be lab-created moissanite!

The disadvantages of thermal conductivity testers is the time required for them to 'warm up', the lack of USB cable connectivity and the Crona-type battery, that is sometimes hard to find.

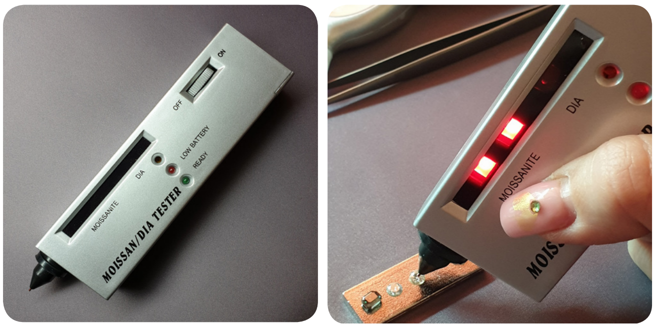
Electrical Conductivity Gem Testers (from $ 10 USD)

These testers work on the principle of electrical conductivity and send an electrical current through the gemstone while at the same time recording its reaction. The principle behind this tester is that while diamonds do not conduct electricity, lab-created moissanite do. Therefore a combination of a thermal conductivity tester and an electrical conductivity tester would allow us to separate diamonds from lab-created moissanite if they are used correctly.

I tried Moissan/DIA Tester for 10$ on various colored and colorless moissanite and it worked well however since sapphires, rubies, cubic zirconia and a host of other stones also do not conduct electricity, it does not help identify stones that are not lab-created moissanite.

Diamond Selector II

The advantage of this tester is that you do not need to wait until it heats up and you could work with it immediately after turning it on. The disadvantages are the same Crona-type battery as in the Diamond Selector II tester and no USB cable support.



Moissan/Dia Tester

Thermal and Electrical Conductivity Gem Testers ($ 80 USD to $ 250 USD)

These types of testers work on both principles at the same time and they are expected to give more accurate results. I tested Gemoro's 'Testarossa' dual conductivity tester with a built-in UV lamp in the probe tip.

I was surprised because it not only distinguished lab-created moissanite from diamond but it even detected ruby and sapphire. In fact, four reactions are possible, GREEN for diamond, BLUE for lab-created moissanite, PINK for sapphire and RED when it comes into contact with metal. The manufacturer states that it can be used to distinguish watch crystals made from lab-created flame-fusion white sapphire from those made from glass.

The tester looks attractive, speaks nine languages, and has a spectacular glowing light bar and worked pretty well. It also has a 'Wow' factor for clients. One advantage is that it can be used to test rough and polished stones but it will not make the distinction between natural and lab-created material.

It also needs time to get warm, should be handled correctly perpendicular to the crown of the testing stone and all measurements must be taken two – three times to ensure accuracy.

One disadvantage is that it does not hold a charge for very long and must be charged each time (using the micro-USB) before testing if you are using rechargeable batteries.

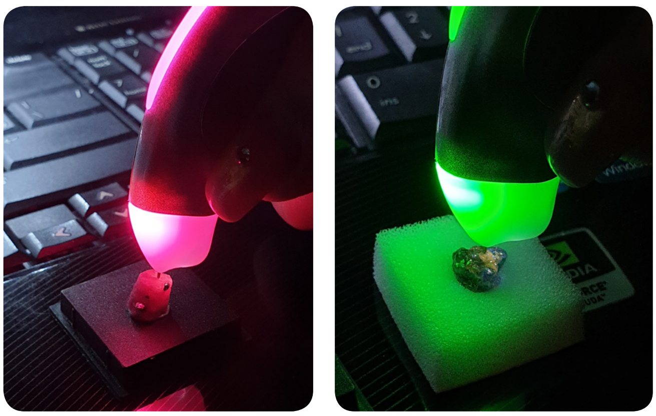
However even if the USB cable is connected to a computer and the batteries have a low charge or are dead, you will not get a correct result. If you are using AAA standard batteries, you should pay close attention to the charge level otherwise it could give erroneous results.

Thermal Refractometer ($ 250 USD to $ 350 USD)

The Presidium Gem Tester was the first gem tester I purchased at the beginning of my gem career.

According to the manufacturer, the Gem Tester 'provides a quick, easy, laboratory proven way to identify diamond and separate the most popular colored gem stones from one another, eliminating human error when identifying precious gems and is based on the principle that different gemstones conduct heat at different rates. By simply touching the Gem Testers sophisticated thermoelectric probe to the surface of any mounted or loose gemstone, the specially calibrated dial will show the relative heat conductivity of the material. Powered by two (2) AA 1.5 V batteries or an AC adapter, calibration is made easy with the two test discs mounted into the frame. The solid state probe pen requires no warm up time between tests and includes a built-in metal detector, which will alert the user if the probe has accidentally come into contact with the mounting instead of the stone.
From my personal experience, the results were far from ideal. For example, you could distinguish a ruby from glass, but because of how the dial is designed, separating tourmaline from tanzanite, or aquamarine or tourmaline from emerald or quartz, was very difficult because the indicators were very close to each other and in some cases even covered each other.

Testarossa - Diamond (Green) or Moissanite (Blue)



Testarossa - Rough Corundum (Pink) or Rough Diamond (Green)

Presidium Gem Tester

Presidium Refractive Index Meter II

After buying an optical refractometer, this tester for me became basically obsolete. Personally, for professional gemologists or anyone who works on an optical refractometer, this tester is like throwing money into the wind.

The main disadvantages were the inaccuracy of the test results and the constant need to calibrate the tester. Sadly, optical refractometers do require a certain level of expertise to not only test the stones but also to arrive at a definitive identification and this is where people are fooled by devices that appear to be user-friendly and promise to take the 'work' out of gem identification.

Digital Refractometer ($ 280 USD to $ 300 USD)

For me, digital refractometers seem to be a much more interesting investment. My tester was also made by Presidium (Presidium PRIM II). Since a contact liquid does not limit this device, it is capable of testing gemstones that are beyond the range of a standard optical refractometer. It however cannot be as accurate as an optical one, because it works on a different principle, measuring the quantity of light reflected from the gemstone and shows just one reading. But it could be an interesting option when you need to separate gemstones with high refractive index.

The disadvantage is that it can also give an incorrect reading but this is generally detectable. When testing a stone, if you see varying results as you rotate it, you know that something is wrong whereas if you get the same result as you rotate the stone, you know it is more than likely correct.

UV Diamond Tester ($ 500 USD to $ 600 USD)

These types of gemstone testers are using for separating Natural Diamonds from their lab-created counterparts and works on the principle of UV transparency. I used the SmartPro Screen I model. When I purchased it, it was cheaper than the one sold by Presidium yet still had the same features.

SmartPro Screen Model I testing a Diamond (Centre) and a Color Enhanced Diamond (Right)

Lab-created Moissanite (Photo by Tino Hammid)

Depending on the UV transmission and absorption of diamond, this device could separate natural diamonds from lab-created diamonds and HPHT from CVD diamonds.
It is important to remember that this device will only work on diamonds so you will need to test the stone first to ensure that it is not a diamond simulant.

The main disadvantage of this tester is that it could give a wrong interpretation of data while you are testing colored diamonds or diamonds that have been color enhanced.

Conclusions

Not one of the gemstone testers mentioned in this article gave results that were 100% correct but they can be used to eliminate certain options and refer others for further testing. The 'WOW' factor aside, relying on these testers without knowing what principles they are based on, their limiting factors and the correct procedures needed to optimize results could result in a catastrophic mistake. Gemstone identification relies on performing numerous tests and then eliminating all other possibilities. These devices have a role to play but they should not be used at the exclusion of other gem testing instruments.

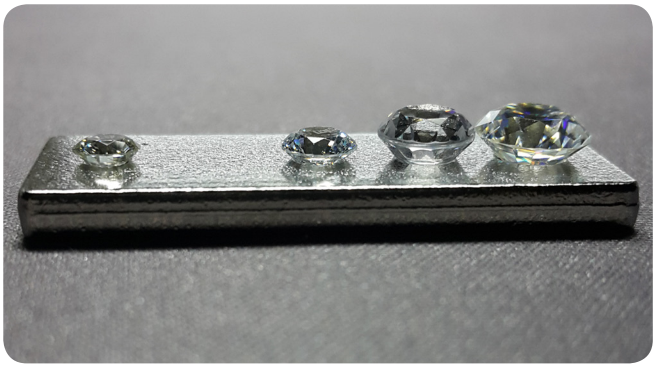
Before buying one, you should clearly understand what role it will play and that largely depends on what stones you intend to test with it.

Here are several 'rules' to follow when using gem testers:

1. Use the correct tester for the correct gemstone.
2. Use the correct testing procedure. Don't hold the stone in your fingers during the testing, because it will get warm. Use the special testing plate provided.
3. Ensure that the testing probe comes into contact perpendicular to the table of the stone.
4. Wait 10-15 seconds between tests.
5. Don't test a gemstone once. Repeat the test several times.
6. Test the stone in different places.
7. Monitor the charge level.
8. Rechargeable batteries could also become unfit so be careful using them.
9. Always keep extra batteries on hand.
10. Testers do make mistakes so don't stop testing a stone until you are sure what it is using a variety of testing methods.
11. Use 'known' test stones to calibrate the tester before testing an unknown stone (i.e. a natural diamond or lab-created moissanite).
12. Always clean the stone thoroughly!

I wish you 'Good Luck' playing with your toys!

Photos by Nina Zolotukhina



Testing Plate

Tester Name	Diamond	Moissanite	Other Stones	R.I.
Diamond Selector II	YES	NO	NO	NO
Moissan/DIA Tester	NO	YES	NO	NO
Gemoro Testarossa	YES	YES	Corundum (Ruby & Sapphire)	NO
Presidium GemTester	YES	NO	YES	NO
SmartPro Screen I	Distinguish Natural or Synthetic	NO	NO	NO
Presidium PRIM II	-	-	-	YES

Out in the Field
Gem Tripping for Gem Fanatics

For most people, buying gemstones and jewellery is a 'blind' purchase, often made on impulse and from sellers who do not always have the best interests of their clients at heart. Kim Rix would like to change that!

Buying Sapphires in Sri Lanka

Know what you're looking at

Taste is a very personal thing. You may fall in love with a gem that is not particularly valuable, and that's just fine. What you want to avoid is paying more than the gem is worth, and that's when a little knowledge comes in very handy.

A good rule of thumb when buying a gem is to remember the Four Cs: colour, clarity, cut and carat. When it comes to buying sapphires, however, you also need to factor in origin and treatment. Let's take these one by one.

Colour

Colour is the most important factor in the price of a sapphire. Sapphires come in many colours, but blue is the most valuable, followed by pink. The most valuable of the pink sapphires is the padparadscha – a rare and beautiful pinkish-orange stone.

The colour of a gemstone incorporates three separate things: the saturation, the hue, and the tone.

Saturation

Saturation refers to the amount of colour in the stone. A stone's saturation is the most important factor in its valuation. Stones with low saturation may appear washed out or greyish, whereas stones with high saturation may appear too dark. The most valuable stones have medium saturation.

Hue

Hue is a more specific term for colour and refers to the particular shade of the stone's colour. Sapphires are described by their primary (dominant) and secondary hues. In a written description of a sapphire, the primary hue will have a capital letter and the secondary hue will have a lower-case letter. For example, you might see a sapphire described as 'greenish Blue', 'pinkish Orange', or simply 'Blue'. The best quality sapphires have only one hue, and blue is the most prized.

Tone

The tone refers to the depth of colour in a stone – how light or dark it appears. A stone that is too light won't show the colour to its best effect, whereas a stone that is too dark will lack brilliance.

Make sure that you look at your stone in both artificial and natural light. Cup your hand over it. The stone should appear lively and brilliant, even in shade.

Clarity

Sapphire usually has inclusions (flaws) when seen under a microscope, so if you are shown a stone that looks flawless under magnification, ask yourself, 'Is it too good to be true?' However, the inclusions in a high-quality stone shouldn't be visible to the naked eye. The position of the inclusion also affects the price. A stone with inclusions in the centre will generally be cheaper than an equivalent stone with an inclusion nearer the edge, for obvious aesthetic reasons.

Cut

The quality and type of cut affects the value. When cutting a gemstone, the aim is to retain as much of the weight as possible while achieving the most beautiful effect. It's a fine balancing act! The oval and cushion cuts are common for sapphires. That's because these cuts enhance a sapphire's lustre while keeping its weight as high as possible. They're also stylish, and easy to set in a piece of jewellery.

Watch out for areas that don't reflect light and so don't seem to sparkle. These are called 'windows' and they detract from the brilliance and value of the stone. A gem with a large face and a shallow bottom will produce this effect.

To check for windowing, place the gem on a piece of paper with text on it and look directly down on it at an angle of 90°. If there is a lighter area in the middle through which you can read the text, the gem has a window. Some sellers will try to overcharge for windowed stones, relying on a tourist's lack of expertise.

I should say here that most stones will demonstrate windowing to some degree when viewed at an angle. What you need to watch out for is windowing that is obvious when viewed directly from above.

Carat

Carats are units of weight in gemstone terminology. The higher the carat, the heavier and more expensive the gemstone. Price per carat increases at 2, 3 and 4 carats. A 4-carat stone will cost more per carat than a 2-carat stone because of the rarity of larger stones. It is rare to find stones over 5 carats, so beware if you are shown a large sapphire at what seems like a surprisingly low price.

Origin

Sri Lanka is the third most highly-rated location in the world for sapphire. Sapphires from Kashmir and Burma are the most highly rated and stones from these countries will attract a premium.

Buyer beware! A packet salted with synthetics (Photo by Kim Rix)

Treatment

In the grand scheme of things, 95% of all gemstones sold have been treated in some way. With sapphires, the figure is closer to 99%. Heat treatment is the norm and is not something that you should worry about – unless you are specifically intending to buy a natural, unheated gemstone, in which case you would be investing thousands of pounds and would expect it to come with a lab report.

Basic heat treatment enhances a sapphire's colour and clarity and shouldn't affect the way that you handle the stone once it is in your possession. However, you do need to be aware of glass-filled (also known as fracture-filled or fissure-filled) stones where, in addition to heat treatment, cracks within the stone have had a glass-like substance injected into them. This method can significantly improve the appearance of a low-quality sapphire that would not otherwise be considered gem quality. However, it introduces the risk that, when exposed to heat in the jewellery mounting process, the filling can melt out of the stone and ruin its appearance. My advice is simple: steer clear of glass-filled gemstones!

Unless you're looking to spend a vast amount of money, the only thing you really need to worry about is whether the gemstone you are about to buy is a genuine sapphire or a piece of cheap fakery. So be on your guard if someone tries to sell you a good-looking, 'untreated' stone!

Remember: if it looks too good to be true, it almost certainly is.

Before you buy, you should always check the stone's certificate or get it tested for authenticity. Do note, though, that it is only possible to test a cut and polished stone for authenticity. Buying a rough stone is more of a risk than buying a cut stone.

Deciding what you want

There are a few questions you need to ask yourself before purchasing:

Cut stone or rough?

Firstly, you should know that it is illegal to take rough stones out of Sri Lanka. However, this does not mean that you cannot buy one. You can take it to any established shop dealer, who will be pleased to cut it for you.

What's the stone for?

For what purpose are you buying a gemstone? Is it for a ring, a brooch, a bracelet, a necklace? Depending on the look you are after, you will need to consider the size and cut of the stone. Another approach is simply to buy a gem that speaks to you and have the setting made to suit that gem.

How much do I want to spend?

This is important. You need to decide on a budget before you approach anywhere that sells gemstones. Arm yourself with a ceiling figure before you start or, in the heat of the moment, you may end up spending more than you want or can afford.

How do I want to pay?

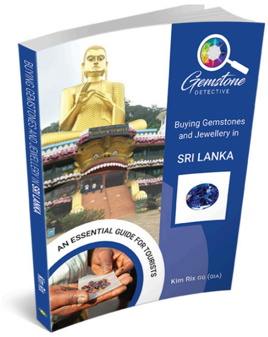
How you want to pay will affect where you buy. Buyers known in the jewellery trade can use their reputations to pay on trust. As a tourist you'll pay cash at the market. If you want to use your credit card, you'll usually need to pay in a shop.

Where do I want to do my gemstone shopping?

Knowing your budget and how you want to pay should determine where you should buy: a luxury hotel, a large and established jewellery shop, at a jewellery show, in a museum, at a small gemstone merchant/trader or at the gemstone market.

This article includes excerpts from Kim's 'Buying Gemstones & Jewellery in Sri Lanka.

To learn more about buying gemstones in Sri Lanka or to purchase the book, contact Kim through her website at www.gemstonedetective.com



Editors Note

I have such fond memories of buying gemstones in Sri Lanka. I do remember however staying at the beautiful Galle Face Hotel in Colombo and waking up at night to find a rather large cockroach crawling across my pillow. The next morning I informed the front desk and they said they would look after it.

Later that day I was meeting a sapphire dealer in my hotel room. We have a selection of very expensive sapphires laid out on the coffee table when suddenly two men marched into my room wearing what looked like Apollo 11 space suits. We thought we were being robbed. They were there of course to fumigate the room but perhaps a little 'heads up' first would have been nice!

This was the same hotel that had signs up saying 'Do not smoke in bed because the ashes we may find may be yours!'. A sobering thought indeed but very effective!

The hotel was also home to Kottarappu Chattu Kuttan, who I met while there, Sri Lanka's most famous doorman who at the time of his death, in 2014, had served at the hotel for 72 years and was one of the oldest hotel employees in the world – at 94 years of age.

Another sobering thought!

Gem trader showing rough (Photo by Kim Rix)

A working mine in Sri Lanka (Photo by Kim Rix)

Gravels being washed at Blue Moonstone Mine, Meetiyagoda (Photo by Kim Rix)

Miners working in Kuruwita, Sri Lanka (Photo by Kim Rix)

A young girl faceting gemstones (Photo by Kim Rix)

Gaminis - a cutting and polishing workshop (Photo by Kim Rix)

Cutting and Polishing (Photo by Kim Rix)

Meet our team of dedicated professionals who all share a common philosophy, a common goal and a passion and commitment to gemmology and education.

Geoffrey M. Dominy
WGF Founder

Geoffrey Dominy is an author, independent gemmologist and former jewellery appraiser who appeared on the Canadian Antiques Roadshow for four seasons. He received his F.G.A through the Gemmological Association of Great Britain (Gem-A) in 1987 passing the diploma examinations with distinction.

Throughout the 1990's, Geoff developed and taught the 'Gemmology' program at Red River Community College and The University of Manitoba in Winnipeg, Canada, worked for the Canadian Institute of Gemmology, was President and Founder of the Jewellery Appraisers Association of Canada and was a contributing author for the 5th & 6th Editions of Robert Webster's 'Gems' which even today is considered one of the most authoritative textbooks in Gemmology.

In 2013, he released the first digital gemmological textbook entitled 'The Handbook of Gemmology' in collaboration with world famous gem photographer Tino Hammid. Now in its fourth edition, the handbook has been sold or downloaded in fifty-three countries, is used by fourteen schools, colleges, universities and gemmological organizations as their recommended textbook and now features photographic contributions by other award winning photographers including Jeff Scovil.

In 2018, Geoff released a 5th Anniversary Printed Edition (Two Volumes) and on December 14th, 2019, released his first book in Spanish 'Gemología Para Todos' (the first 14 chapters of the Handbook of Gemmology).

He currently lives in Palma, Mallorca, Spain and in addition to lecturing and promoting his books, is the founder of the World Gem Foundation and Mi Isla También.

Leone Langeslag
Dutch Gem Academy

Leone Langeslag is a graduate of the Federation for European Education in Gemmology (FEEG) (2006), an independent gemmological consultant and is actively involved with the Gemma Association in Holland offering lectures and workshops. Her desire to provide accessible gemmological training in the Netherlands has lead to the formation of the Dutch Gem Academy.

Leone is a frequent visitor to international symposiums, exhibitions and trade shows where she continues her own gemmological education and passion for collecting gemstones and minerals.

Deborah Mazza
British Gem Academy

Deborah Mazza is half Italian and half British, and started her journey through the world of gemstones in Germany in 1984, where she studied at the Deutsche Gemmologische Gesellschaft attaining her gemmology and diamond diploma; she subsequently gained her FGA in 1986.

Deborah then went to work for the trade in Idar-Oberstein, buying and selling wholesale gems and diamonds, working as a gemmologist and teaching gemmology at the DGemG, this lead on to carrying out jewellery valuations for an insurance company in Germany. She later got a Bachelor in Business in Germany, and returned to the UK in 2010, where she became a tutor for the Gem-A's online courses. Deborah, keen to add to her knowledge, started to study again and passed the NAJ/IRV's CAT jewellery valuation diploma, and is now studying History of Art at Goldsmiths University. Deborah has her own valuation business and works part-time for an online auction house. She contributed several written pieces for Yavorskyy's new book, Terra Connoisseur: Gemstones. She is currently the Director of Education for the British Gem Academy.

Conny Forsberg
Scandinavian Gem Academy

Conny Forsberg has over thirty years experience as a gemmologist and precision gem cutter. He received his FGA in 1986 through Gem-A, his diamond grading diploma through Hoge Raad voor Diamant (HRD) in 1994 and is an Accredited Senior Gemologist with the Accredited Gemologist Association (AGA).

He is currently the owner of the Swedish Gem AB, a modern and accomplished gem lab as well as a precision cutting facility. He has twice received 'Honourable' mention in the Gem-A photo competition for his photomicrography (2011 & 2013) and is a valued contributor to the Handbook of Gemmology, with a large collection of his photomicrographies planned for the upcoming 4th Edition. Conny is also an Accredited PRINCE2 Practitioner (Project Management), experienced in public procurement and contracting (EU law) and the initiator and organizer of the Scandinavian Gem Symposium. He is currently the auditor for the Swedish Gemmological Association.

Jan Asplund
Scandinavian Gem Academy

Jan Asplund is a gemmological consultant specializing primarily in the identification and valuation of diamonds, both cut and rough, as well as coloured gemstones and jewellery.

He received his FGA & DGA (Gem Diamond Diploma) through Gem-A in 2011, his BA in History from the Mälardalens University in 2000 and studied geology and gemmology at Luleå Technical University (2005 – 2007), cultural and industrial history at the Uppsala University (1998 – 2000), and archival science at Karlstads University (1998 – 1999). Jan also took his Accredited Jewelry Professional – AJP (Gemological Institute of America 2011), Introduction to Watches (International School of Gemology 2012), Jewellers Education Foundation – Graduate Sales Associate (American Gem Society 2011), Blacksmithing (Säterglántan 2002) and Silversmithing (Tärna Folkhögskola 1996).

He is a board member of the Swedish Gemmological Association, fellow and diamond member of Gem-A and initiator and organizer of the Scandinavian Gem Symposium.

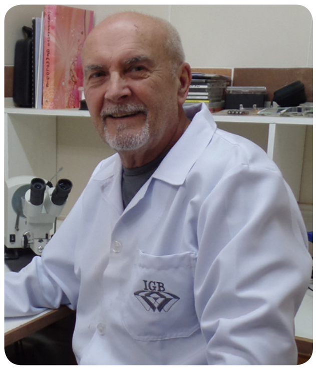
Leroy Bakelmun
Gem Academy of Canada

Leroy Bakelmun started his gemmological career after receiving his certificate in gem cutting and polishing at the Lapidary Training Centre Sri Lanka in 1995. In the same year he also received his certificate in Gem Identification, through the A.K. Institute of Gemmology in Sri Lanka.

In 2006 he received his 'Gemmologist' certificate through the Canadian Institute of Gemmology (C.I.G.)

Leroy has extensive experience buying and selling gemstones. From 1997 to 2014, he owned and operated GeoGem Jewellers in Langley, British Columbia, Canada and from 2012 to 2014, he also owned the 925 House of Silver in Fort Langley, British Columbia, Canada.

Gérard Raphaël Quintin was born in Paris France where he studied Art and Design and graduated from Ecole Boulle. His taste for the diamond world may have been inherited from an uncle who worked in the diamond business.



Gérard Raphaël Quintin
South American Gem Academy

In 1978 he took the gemology colored stone and diamond course with GIA while he was mining diamonds in the Sewa River in Sierra Leone and where he started the first diamond cutting center in West Africa.

In Abidjan Côte d'Ivoire in 1992 Gérard founded the diamond cutting formation center with a gemological laboratory 'Hardy's', followed by the installation of the colored stone and diamond cutting facilities in the jewelry school EIBMA.

Continuing his tour in the world of gemstones, Gérard went to Madagascar as an expert for a French Government project to develop the organization and skill of the gems sector.

Professor of Gemology in the Jean Guehenno Jewelry School in Saint-Amand-Montrond France, he then moved to Bolivia to fund and manage the 'Instituto Gemologico Boliviano' where students learn gemology and the art of gem cutting.

Since 1997 Gérard has been a member of the Organisation Internationale des Experts based in Geneva, Switzerland.

Cristina Rzepka de Lombas
Central American and
Caribbean Gem Academies

Cristina Rzepka de Lombas is a geologist, gemmologist, appraiser of gemstones and jewellery and an expert in diamond and coloured gemstone grading.

Currently Cristine serves on the Board of Directors of the Instituto Gemológico Español (IGE) in Madrid, Spain where she also teaches their 'Gems of Organic Origin' course.

She is also the Director of Education for the Central American and Caribbean Gem Academies.

Kyalo Kiilu is a fellow of the Gemmological Association of Great Britain (Gem-A) and an Alumnus of Birmingham City University where he obtained his BSc with honours in Gemmology and Jewellery Studies in 2017.

Kyalo Kiilu
East African Gem Academy

His passion for gemstones can be traced back forty years to his late grandmother's village in rural Kenya and the prospecting trench dug by the first British gemstone explorers in the early part of the 20th Century.

While pursuing his pharmaceutical studies, his interest in gemstones never diminished. Unfortunately in 2003 there were no colleges in Kenya offering gemmological courses so he decided to relocate to England and enrolled in Gem-A's Diamond Diploma program in 2004; the start of his gemmological journey.

Kyalo is a licenced gemstone prospector in Kenya and in 2015 made a discovery of a very unique sapphire, resembling another Kenyan sapphire marketed as 'Goldsheen Sapphire' that he will hopefully share with the gemmological community very soon.

He comes to the World Gem Foundation and specifically the East African Gem Academy with a strong desire and ambition to share his knowledge of gemstones with his fellow East Africans, particularly those involved in the production of gemstones, gemstone lovers and aspiring gemmologists, to provide support and encouragement that was so lacking in the industry when he was growing up in Kenya.

Salomon Lutumba
Gem Academy of DR Congo

Salomon Lutumba is an alumnus of Birmingham City University where he graduated with a Bachelor in Science with honours in Gemmology and Jewellery studies in 2016. He also holds a Diamond Diploma and Gemmology certificate from Gem-A. He is originally from the Democratic Republic of Congo.

In 2002 he relocated to England where, ten years later, he found the opportunity to fulfil his dream of studying gemmology at the Birmingham City University. In 2012, he started his High National Diploma in Gemmology combined with Gem-A's Diamond and Gemmology program which led to a degree program, introduced for the first time in 2015, at the BCU.

Today, by embracing the World Gem Foundation's concept and philosophy of gemmological education, and through the Gem Academy of DR Congo, he would like to share his passion and knowledge of gems with his fellow Congolese; particularly jewellers, aspiring gemmologist and gemstone lovers.

His personal goal is to promote the science of gemmology in his country, by providing information and support to empower people in the jewellery business and those trading in stones.

Jack Ghazalian
American Gem Academy
Director of Corporate & Career Development

Jack Ghazalian has thirty-eight years of experience in the jewelry industry. He is a graduate gemologist through the Gemological Institute of America (1992), was an instructor for GIA (1993) and was officially Certified-by-the-State of California Education Code 94311(a) to teach Gemology & Jewelry Manufacturing-Arts (1993).

In October 2015, he was honored by the International Distinguished Scholars – Academic Honor Society as an 'International Distinguished Scholar' and in 2017 was granted membership in Kappa Delta Pi. He is currently the owner of Isometric Gemological Appraisal Services in Southern California: IsometricGems.com, speaks five languages and is passionate about education.

Barickeh Charles Kholifa Koroma is a freelance gemmologist, diamond grader/ valuer, a member of the Gemmological Association of Great Britain and a member of the Scottish Gemmological Association. He was born in Liberia to Sierra Leonean parents and raised in the mineral rich country of Sierra Leone where he survived a devastating brutal civil war which lasted for almost 12 years.

Barickeh Charles Kholifa Koroma
West African Gem Academy

He relocated to the United Kingdom in 2004 and received help on how to cope with Post Traumatic Stress Disorder (PTSD), which now proves pivotal in his approach to life.

He attended the coveted School of Jewellery, Birmingham City University (BCU) where he studied a diploma in diamonds (Gem-A) and a BSc (Hons) in Gemmology and Jewellery Studies. He graduated with a first-class degree in 2018 and was awarded the prestigious Scottish Gemmological Association Prize for Gemmology. He then moved back to Sierra Leone to pursue his dreams. His greatest achievement so far is working as a student mentor during his time at the university, he was able to give advice and guidance to some students that were struggling to cope with the demands of higher education and being away from home.

Like Kyalo, he comes to the World Gem Foundation and specifically the West African Gem Academy with a strong desire and ambition to share his knowledge of gemstones with his fellow West Africans, particularly those involved in the production of gemstones, gemstone lovers and aspiring gemmologists, to provide support and encouragement that was so lacking in the industry when he was growing up in Sierra Leone.

Ludovic Durand Oro
French-Swiss Gem Academy

Ludovic Durand Oro graduated from the Federation for European Education in Gemmology (FEEG) in 2012, has taught at the French Gemological Institute in Paris (France), was the Director of Education of a gem school based in Monaco and in 2019 co-founded the Academy of Applied & Technical Gemology (AGAT gem school) as well as the French-Swiss Gem Academy (FSGA), both based on the French Riviera in Nice, in the south of France.

A true gem enthusiast, he loves to organize gem field trips for his students to gem producing areas around the world while also acquiring top quality gemstones for his private clients.

Dr. Laurent Massi completed his PhD studies on 'Atomic-scale Defects in Brown and Hydrogen-rich Diamonds' at the Department of Physics at Nantes University in France under the direction of Professor Emmanuel Fritsch. During his studies he also taught gemology in Paris at the French National Gemological Institute. Dr. Massi subsequently taught gemology and gave presentations at conferences in numerous countries all around the world. During his career he has also had the opportunity to publish a variety of scientific and educational articles on color-change corundum, hydrogen- and CO2-related optical centers in diamond, chameleon diamonds, clinohumite, color-change bastnäsite and on a new gem mineral: hibonite, one of the rarest gems on Earth.

Dr. Laurent Massi
French-Swiss Gem Academy

Dr. Massi was the Director of the Asian Institute of Gemological Sciences (AIGS) Gem Laboratory and Gem School based in Bangkok - Thailand. He subsequently completed his Graduate Gemologist (GG) studies at the Gemological Institute of America (GIA) headquarters in Carlsbad, USA and then became the Director of the new GIA Thailand Campus located in Bangkok - Thailand.

With more than 20 years of experience in the Gems & Jewelry industry, Dr. Massi is now the head of both the new international gem academy AGAT (for 'Academy of Applied & Technical Gemology') as well as the co-founder of the French-Swiss Gem Academy (from the World Gem Foundation), both housed in the Majestic building - a former palace from the Belle Epoque - located on the French Riviera, in Nice - France.

The Learning Curve

Educate and Evaluate

In this issue, ZOHREH AMINI takes a close look at Turquoise ‘The Jewel of the Orient’, one of the oldest gemstones mined and crafted into jewelry dating back over 8000 years.

Turquoise ‘The Jewel of the Orient’

Turquoise has been appreciated as a gemstone for thousands of years. Today it is recognized as the December birthstone and in terms of gemstones, an appropriate stone to celebrate an eleventh wedding anniversary.

It is a blue to green non-transparent (opaque) mineral that is most highly prized when found in a pure translucent blue colouration that is free of veining (inclusions).

It is secondary mineral deposit in the Earth’s crust and is found in a number of different locations around the world that all share the same characteristics; dry/barren and arid regions where there is no more than 10 inches of rain a year. Turquoise is typically found at depths of less than 20 meters but can in some cases occur at greater depths.

A by-product of copper mining, turquoise is a hydrated phosphate of aluminum and copper where the cause of color is copper (blue color), iron (green color) or zinc (yellow color).

Properties	Values
Crystal System	Triclinic
Chemical Composition	$(CuAl_6 (PO_4)_4(OH)_8 - 4H_2O$
Colour Range	Blue, Bluish-Green
Refractive Index	1.610 – 1.650
Birefringence	.040
Dispersion	-
Optic Character	Biaxial
Optic Sign	Positive
Pleochroism	-
Specific Gravity	2.31 – 2.84
Hardness	5 – 6 ½
Cleavage	None
Fracture	Uneven, Conchoidal
Lustre	Waxy
Transparency	Opaque
Colour Streak	White

Inclusions in turquoise are typically a very dark brown, gray or tan color appearing in vein-like patterns of matrix. Pyrite with silver color lines is another inclusion found in turquoise.

The surface of fine quality turquoise is very hard and can take a high polish, however, many turquoise with excellent colors have a chalky surface that cannot be polished without a treatment procedure called ‘Stabilizing’ where special resins are used in order to make the surface polishable. During the cutting and processing of turquoise, a lot of fine particles of turquoise (powder) are produced. This powder is collected and combined with a glue to produce blocks of turquoise. When these blocks are cut, polished and set into jewelry it is very difficult, without using advanced gem testing procedures, to distinguished reconstituted turquoise from natural turquoise.

Turquoise Deposits

The most important turquoise mines are found in the Southwest of the United States, Persia (modern name Iran) and China. However turquoise has also been found in Afghanistan, Peru, Chile, Mongolia, Bulgaria, Australia, Egypt Ethiopia, Tanzania, Poland, Great Britain, Middle Asia, Kazakhstan and Armenia.

United States

Most of the turquoise mines in the USA are located in Arizona (the major and best supplier in the US) followed by Nevada. Most of the mines in the US were initially discovered around 200 BC by Native American Indians. Native Indian tribes in the US considered turquoise an important element for protection and the well-being of the mind and body and because of this, it has been featured extensively in traditional American Indian jewelry.

Experts are of the opinion that at the present time the best quality turquoise is produced by mines in Arizona and Iran.

Persian Turquoise (Photo by Tino Hammid)

China

Archeological evidence shows that turquoise was used in China as far back as 1700 BC. In Ancient times there were only a few turquoise mines in China and most of the turquoise was acquired through trade with Persians, Turks and Mongols. Furthermore, until the 1980's the popular stone in China with the exception of Tibet was jade, not turquoise.

China is now the world's largest supplier of turquoise and accounts for 60 to 80% of the turquoise sold in the United States with mines located northwest of Shanghai (Ma'ashan Turquoise Mine) and in the Hubei Province where turquoise reminiscent of turquoise from Nevada is found. Almost all Chinese turquoise requires stabilizing. China also ranks #1 as the producer of fake gemstones including turquoise.

Egypt

Turquoise is one the oldest gemstones mined and crafted into jewelry. Archaeological findings show that turquoise was mined since at least 6000 BC. In fact, the oldest turquoise jewelry found came from the Royal Tombs at Abydos, in Upper Egypt.

Archaeologist claim that the turquoise and other items found in this tomb are from approximately 5500 BC. Turquoise was the most famous and treasured gem for Ancient Egyptians and was considered a 'Holy Stone' that would bring good luck and protect them against evil, danger and disease. In fact, turquoise was so important to Ancient Egyptians that the gem had its own Goddess, Hathor.

Egyptians produced turquoise from mines located in the Sinai Peninsula, which was called the 'Country of Turquoise' by the natives. These mines are believed to be the oldest turquoise mines. However, in contrast with the past, large scale mining is no longer profitable today.

Although in the past very fine turquoise was mined and produced in Egypt, today Egyptian turquoise is low in quality and very soft. Some initiatives have been taken to apply the right treatment so as to make Egyptian turquoise more presentable and marketable.

Persian Turquoise (Firozeh)

The name turquoise is derived from the French word 'Pierre Turquoise' meaning stone from Turkey. However, although Turkey had nothing to do with the mining and production of turquoise, French traders applied the name since very fine turquoises were traded in Turkish markets. Later it was discovered that the fine turquoise they were dealing in were coming from mines in Persia (modern name Iran).

Nowadays in Iran, turquoise is named 'Firouzeh'. In the past the gemstone was called 'Pyrouzeh', meaning 'victory' in Farsi, the local language.

Ancient Persians, like Ancient Egyptians, also believed that turquoise held many powers with some believing that the reflection of the new moon on a turquoise would bring good luck and guard against evil.

Persian turquoise dates back well over 4000 years and for the last 2000 years it has been considered the 'Jewel of the Orient'. The region known as Persia (modern name Iran) has been the main source for the highest quality turquoise in the world, renowned for its clear sky blue to deep rich dark blue color. It is the most sought-after gemstone in the history of the modern world.

The ancient Persian grading system classified turquoise into three quality groups:

Angoustari - this is the first quality suitable for the finest jewelry that has a rich blue color with little marking or matrix.

Barkhaneh - this is the second quality, similar to Angoustari but with more markings and matrix.

Arabi - these stones were considered third rate due to their pale blue or green shade or unwanted speckles.

What is most interesting however is that the modern turquoise grading system closely mirrors the ancient Persian grading scale.

Lesser Quality Matrix Turquoise (Pre-stabilization)
(Photo by Zohreh Amin)

Stabilized Turquoise
(Photo by Zohreh Amini)

The best Persian turquoise is produced from mines around Iran's Northeastern City of Nyeshapour, located 150 kilometers from the city of Mashhad in Khorasan Razavi Province and date back to 4000 BC. Nyeshapour once was a significant point on the ancient Silk Road linking Anatolia (the Asian part of present Turkey) on the Mediterranean to China. It is believed that turquoise mines in Nyeshapour and the Egyptian mines in Sinai are the oldest gemstone mines that ever existed.

As in the past, Iranians today love Persian turquoise and there is a high domestic demand for the gem. This is one of the reasons why only small quantities of Persian turquoise are available for export.

The robin's egg blue Persian turquoise is used in the making of jewelry and the creation of mosaics. Some of the finest, most beautiful and attractive monuments over the centuries were created using inlays and overlays of turquoise. Two characteristics of Persian turquoise that make it very appealing is its propensity to take a high polish and color stability over time.

Firouzeh Koobi or turquoise inlaying on jewelry and silver, bronze and copper containers to make Iranian handcrafts is very popular in Iran. Also, turquoise Koobi (turquoise fixing) is used in calligraphy artwork.

Recently, the export of Persian turquoise to most countries has dropped substantially due to the scarcity of Persian turquoise and sanctions imposed on Iran.

Turquoise Treatments

Throughout time, wax and oil has been used to improve the color of turquoise, making it appear brighter and more intense, however it should be noted that stones treated in this manner can 'sweat' if exposed to heat or sunlight.

Stabilization

In this method of treatment, an oil or water based resin is used. Each artisan has his/her own secret formula of making resin depending on the location of the mine and the quality of the turquoise. This improves the color and the uniformity of the color.

Reconstitution

Glue is added to powdered turquoise in order to make large-sized turquoise. It should be noted that in this method, the treater may add fake material to the powdered turquoise.

Backing

Often fine quality turquoise is mined in thin layers. In this case, the artisan may glue the turquoise to a stronger stone or use special lightweight resin to increase the durability of the stone.

Fake Turquoise

The majority of fake turquoise is made in China and includes dyed magnesite and howlite. After adding the dye, the stones are then stabilized using a plastic resin. Since 2012, the Chinese have used 'cement' to make fake turquoise, turning the production and business of fake turquoise into a science.

About Zohreh..

Zohreh Amini is a Gemologist/Designer located in Washington DC with over 20 years of experience.

Literary Speaking

Expand your Mind

In this issue Jan Asplund looks at Lacloche Joalliers by Laurence Mouillefarine and Véronique Ristelhueber with a foreword by Francis Lacloche.

"She takes a cigarette out of her case.
Charles – That's an enchanting case.
Larita – it is a darling.
Charles - Cartier?
Larita - No Lacloche. I´ve had it for years."

The above quote appears in the book Lacloche Joalliers and is taken from the movie Easy Virtue written by Noel Coward in 1924. The dialogue is an indication on how well known Lacloche was in the early part of the 20th century. There was rivalry between Lacloche and Cartier and the two firms were equally well-known and made pieces of the highest quality and also often of a similar design. Today few know about Lacloch while Cariter remains a household name.

Lacloch Joalliere is a bi-lingual publication with texts in French and English with an accompanying exhibition with the same name at L´École des Arts Joailliers in Paris during October-December 2019.

In addition to writing the first monograph of Lacloche, the authors have tried to identify a specific 'Lacloche' style. However proving that such a style existed has proven difficult for several reasons. One is that there are no archives preserved from the years 1892-1931 so the authors had to rely on descriptions of the jewellery and how they compared to others in newspapers and magazines at the time. Another reason it was difficult to attach a particular style to any Parisian jeweller in the early 20th century is that during this time, many designers working at smaller workshops around the city offered their designs to the more important jewellers or offered to produce jewellery components. Often this went undocumented making it almost impossible to identify who actually designed a piece. To make it even more complicated, many designers sold the same design with minor changes to a number of jewellers.

The chapter 'The Paris Workshop', implies that Paris was a big jewellery workshop, consisting of thousands of smaller jewellery workshops in addition to the large and exclusive maisons such as Cartier, Boucheron, Chaumet, Chopard, Van Cleef & Arpels and others. The chapter is dedicated to twenty-five of the most important workshops that created the designs and handled the production for Lacloche. It is a very nice chapter with many pictures of drawings, designs and hallmarks putting the spotlight on the high quality production going on all over Paris especially during the interwar period. Many of the resulting designs were bought and are still owned by the larger maisons who hallmarked their pieces with their own symbols and names. Without preserved records it is often not possible to identify the original designer of a piece but this chapter does some important work in the field and explains the striking similarities between some pieces sold by different maisons.

The history of Laloche consists of two parts: the founding of 'Lacloche Fréres Joailliers Fabricants' by Léopold and Jules Lacloche in 1892 until their bankrupcy in 1931, as a result of the brothers gambling problems and the re-launch in 1936 of the firm by Jaques Lacloche, son of the third and youngest brother Fernand, until the closure of the store at Place Vendome in 1967.

One chapter is dedicated to the Exposition Internationale des Arts Décoratifs et Industriels Modernes, the birthplace of Art Deco. In Paris 1925, Lacloche exhibited at the centre of the jewellery hall with Cartier, Van Cleef & Arpel, Dusausoy and Sandoz as closest neighbours. Four years later Lacloche was at the centre of another important exhibition described in the chapter 'The Deep White Silence'. The Exposition des Artes de la Bijouterie Joaillerie Orfévrerie had only eight exhibitors but the designs presented were still in the Art Deco style however now, diamonds and platinum dominated the pieces with only the occasional coloured stone in what Henri Clouzot described as the 'Great White Silence'.

Does the book succeed in defining a certain Lacloche style? The quality and design of the pieces made before 1931 is certainly of a quality similar or even better than other contemporary jewellers with Oriental and Egyptian influences more obvious in jewellery and other objects made by Lacloche than others, but it is still hard to find any easily identifiable features highlighting that a certain piece must be a Lacloche. The vanity cases are similar to the ones by Cartier, the Egyptian style bracelets are strikingly similar to Van Cleef & Arpels and the Far East inspired lacquered brooch-watches are hard to separate from Boucherons or Tiffany´s. If the companies records had survived it might have been possible to determine who was first with a certain style or design. Perhaps the exception is the lace or embroidery like pieces made out of platinum with large quantities of smaller diamonds and pearls, only on occasion with coloured gemstones perhaps to appeal to the Indian market.

Jaques Lacloches jewellery bears some resemblance to earlier pieces but the workmanship and finish is not of the same high quality. Instead he created more unique and daring designs that demonstrated his technical innovative skills when filing a patent for a transformable clip. Brooches in the form of ballerinas and scarecrows are the most striking and easiest to recognise (who can forget the 1938 scarecrow brooch with the secret mechanism that erects its penis!).

Laurence Mouillefarine and Véronique Ristelhueber have written an excellent monograph of an important jeweller that few today have heard of. The book is easy to read and the text is accompanied by a lot of beautiful photographs of jewellery, original drawings, ads and original order registers giving a feeling of a very complete work. As the company no longer exists it has been possible for the authors to give a more complete and objective view on the history than often is the case with large jewellery companies that are still active and concerned about how they are perceived and portrayed.

Lacloche Joalliers by Laurence Mouillefarine and Véronique Ristelhueber with a foreword by Francis Lacloche.

320 pages.

Published by Éditions Norma and the L´École des Arts Joaillers 2019.

https://www.editions-norma.com/collections/nouveautes/products/lacloche-joailliers

CHAPITRE 3

JACQUES LACLOCHE, ENTRE CANNES ET LA PLACE VENDÔME

Magasin Jacques Lacloche, 8, place Vendôme à Paris. Photographie de Marcel Bovis.

Page de gauche

Pyjama de plage créé par Chanel. Photographie du studio Liugi Diaz parue dans *Les Modes*, n° 387, août 1936.

Jacques Lacloche store, 8, place Vendôme in Paris. Photograph by Marcel Bovis.

Left-hand page

Beach pajamas created by Chanel. Photograph by the Liugi Diaz studio published in *Les Modes*, no. 387, August 1936.

JACQUES LACLOCHE, BETWEEN CANNES AND THE PLACE VENDÔME

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Andalusite (Photo by Tino Hammid)

LEONE LANGESLAG is the CEO of the Dutch Gem Academy and owner of Sole Leone. She received her European Gemmologist (E.G.) diploma from the Federation for European Education in Gemmology (FEEG) in 2006.

Andalusite - splish, splash and lots of flash

Selection of Andalusite (Photo by David Thompson)

Andalusite is a charming and attractive gemstone that is also quite unusual. Known for its pleochroism, fine andalusite can display an array of 'earthy' colours, simultaneously ranging from green, to yellow, orange, brown and red. Often referred to as a 'Poor Man's Alexandrite', the colours in andalusite are caused by differential absorption of light (DSA) while in alexandrite the change of colour (depending on the light source) it is caused by a property known as metamerism.

Etymology

The name andalusite is derived from the autonomous region of Andalusia in Spain and was first discovered in the Ronda Massif, Malaga in 1789.

Geology

Andalusite is a mineral that was formed by volcanic activity millions of years ago. Magma or molten rock emerged from beneath the earth's crust and came into contact with clay and shale rock formations. The heat of the magma melted the minerals in the clay and shale and intense pressure over time created the crystals.

Localities

Gem quality andalusite can be found nowadays in Australia, Brazil, South Africa, Sri Lanka and the Inyo Mountains of California in addition to Spain.

Chemical Composition and Varieties

Andalusite, like many other gemstones, is an aluminium silicate ($AlSiO_3$) and polymorphous with the minerals kyanite and fibrolite (sillimanite). Belonging to the orthorhombic crystal system, crystals have a pragmatic habit with vertically striated prisms, which are nearly square in section and capped with pyramids. Most gem andalusite is found as water-worn pebbles.

Certain varieties of andalusite are considered to be quite rare, these include:

Chiastolite - an opaque (impure) variety of andalusite that occurs in square prisms and is characterized by carbonaceous inclusions that form a dark brown or black cross through the middle.

Viridine - a small bright green variety of andalusite, seldom found in sizes larger than 1 carat.

Cat's Eye Andalusite - stones displaying chatoyancy when cut 'en cabochon'.

Properties	Values
Crystal System	Orthorhombic
Chemical Composition	Al_2SiO_5
Colour Range	Yellow-Green/Green/Brownish-Red
Refractive Index	1.627 – 1.649
Birefringence	.007 – .013
Dispersion	.016
Optic Character	Biaxial
Optic Sign	Negative
Specific Gravity	3.05 – 3.20
Hardness	7 ½
Cleavage	Distinct (Prismatic)
Fracture	Sub-conchoidal, Uneven, Brittle
Lustre	Vitreous
Transparency	Transparent to Opaque
Colour Streak	White
Colour Streak	White

Other gemstones that have similar properties to andalusite are kornerupine and iolite. Kornerupine can be distinguished from andalusite by its higher R.I. (1.660 - 1.699) and higher specific gravity (3.27 - 3.45) while iolite has both a lower R.I. (1.524 - 1.578) and S.G. (2.58 - 2.66). The hardness of andalusite is 7,5 on the Mohs Hardness Scale.

Andalusite also exhibits a property known as cleavage, which is defined as a ‘tendency for a crystalline substance to split parallel to certain definite crystallographic directions (when force is applied), producing more or less smooth surfaces. It is strictly a directional property that can only occur in crystalline substances and is due to weaknesses in the orderly placement of the atoms within a crystal.

Colour

Colours range from yellow-green to brownish-green with brownish-red overtones. The colour is caused by traces of impurities such as titanium (Ti^{4+}) or iron (Fe^{2+}) during its formation but the flash of colours are caused by the arrangement of crystals within the gemstone affecting the light as it enters. If you view it from different angles you can distinguish all the colours with the naked eye. In deep green andalusite from Brazil, manganese is responsible for the colour.

Pleochroism

Andalusite provides a good example of trichoism (three colours). When it is viewed with the dichroscope in one direction, you may see yellow in one window and green in the other. Then, when viewing it from another direction, you might see the same yellow as in the first pair of colours and in addition a reddish-brown in the other window.

Absorption Spectra

The deep green variety from Brazil exhibits a manganese spectrum while the brownish-green material with reddish flashes from Sri Lanka has strong absorption in the blue/violet region where only the 455nm absorption band may be visible.

Inclusions

Andalusite can contain rutile needles, which can detract from its overall appearance, liquid filled inclusions (carbon dioxide or nitrogen), iron-stained apatite, biotite and euhedral quartz crystals and mica.

Fluorescence

Andalusite is inert under long-wave UV light. Brownish-green stones from Brazil exhibit a dark green to yellowish green glow under short-wave radiations and a greenish-yellowish fluorescence when exposed to X-rays.

Cut

The goal of every andalusite cutter is to enhance its pleochroism. Therefore the shape and orientation are very important. In the finest stones, the pleochroic colours can be seen almost simultaneously with little movement of the stone.

Treatments and Enhancements

Heat treatment produces a pinkish colouration in olive-green material from Brazil, while brownish andalusite is reported to fade above 800 degrees C to colourless.

Synthesis

Andalusite is not produced commercially.

Simulants

Although kornerupine and iolite can look initially like andalusite, identification is quite straight forward using standard gemological testing procedures.

Cleaning and Care

Andalusite should not be cleaned in an ultrasonic cleaner due to its distinct cleavage. When working on stones that have liquid-filled inclusions, care should be taken since the heat can cause inclusions to expand and cause a fracturing of the stones.

Conclusion

For lovers of ‘earthy colours’, andalusite is an ideal gemstone to own. Prized for its trichroism, it is still extremely affordable with a three-carat extra fine quality stone wholesaling for around $ 600 USD while a similar sized alexandrite in the same quality would wholesale for well over $ 112,500 USD. That’s an increase of 18650%! Food for thought indeed!

References:

Handbook of Gemmology
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Gemdat.org
GemGuide (March/April 2020)


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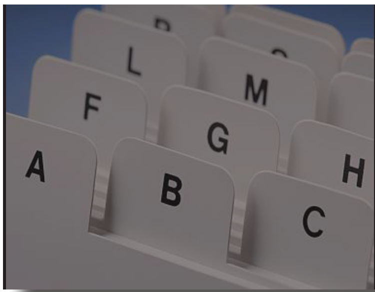

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